Palos Verdes Peninsula Enhanced Watershed Management Program Work Plan

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The Los Angeles Regional Water Quality Control Board

Prepared by:
Palos Verdes Peninsula Watershed Management Group

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List of Acronyms

303(d) List	California's Clean Water Act Section 303(d) List
AED	Allowable Exceedance Day
ASCE	American Society of Civil Engineers
BMP	Best Management Practices
CASQA	California Stormwater Quality Association
CGP	The State Board's Construction General Permit Order No. 2009-0009-DWQ, or as amended.
CIMP	The Coordinated Integrated Monitoring Program for the Palos Verdes Peninsula CIMP Group
CIWQS	California Integrated Water Quality System
CML	Coordinated Monitoring Location
CSMP	Coordinated Shoreline Monitoring Plan
CTR	California Toxics Rule
CWA	Clean Water Act
DCu	Dissolved copper
DDE	Dichloro-diphenyl-dichloroethylene
DDT	Dichloro-diphenyl-trichloroethane
DP	Dissolved Phosphorus
DZn	Dissolved zinc
EMC	Event Mean Concentration
EWMP	The Palos Verdes Peninsula Enhanced Watershed Management Program
FC	Fecal coliform
GIS	Geographic Information System
HUC	Hydrologic Unit Code
IBD	International BMP Database
ICID	Illicit Connections and Illicit Discharges
IGP	The State Board's Industrial Storm Water General Permit Order No. 2014-0057-DWQ, or as amended.
IPM	Integrated Pest Management Program
JWPCP	Los Angeles County Joint Water Pollution Control Plant
LA	Load Allocation
LACFCD	Los Angeles County Flood Control District
LACSD	Los Angeles County Sanitation Districts
LID	Low Impact Development
MCM	Minimum Control Measure
MFAC	Minimum Frequency of Assessment and Collection
MS4	Municipal Separate Storm Sewer System
MS4 Permit	The Los Angeles Regional Water Quality Control Board Order No. R4-2012-0175
NH3	Ammonia as N

List of Acronyms

NO3	Nitrate as N
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRDC	Natural Resources Defense Council
O&M	Operations and Maintenance
PAH	Polycyclic Aromatic Hydrocarbon
PCBs	Polychlorinated Biphenyls
Peninsula WMG	Peninsula Watershed Management Group
RAA	Reasonable Assurance Analysis
RAO	Remedial Action Objective
Regional Board	California Regional Water Quality Control Board, Los Angeles Region
RWL	Receiving Water Limitation
SBPAT	Structural BMP Prioritization and Analysis Tool
SCCWRP	Southern California Coastal Water Research Project
SMARTS	State Water Resources Control Board's Storm Water Multiple Application and Report Tracking System
SMB	Santa Monica Bay
SSO	Sewer Leaks, sanitary sewer overflow
State Board	California State Water Resources Control Board
State Listing Policy	State Board's Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List
SUSMP	Standard Urban Stormwater Mitigation Plan
SWMM	Stormwater Management Model
SWPPP	Stormwater Pollution Prevention Plan
TBT	Tributyltin
TCu	Total copper
TKN	Total Kjeldahl nitrogen
TPb	Total lead
TMDL	Total Maximum Daily Load
TP	Total Phosphorus
TSS	Total Suspended Solids
TZn	Total zinc
USEPA	United States Environmental Protection Agency
WCM	Watershed Control Measure
WERF	Water Environment Research Foundation
WLA	Waste Load Allocations
WMP	Watershed Management Plan
WQBEL	Water Quality Based Effluent Limitations
WQP	Water Quality Priority

1. Introduction

The 2012 Municipal Separate Storm Sewer System Permit[1] (MS4 Permit) was adopted on November 8, 2012, by the Los Angeles Regional Water Quality Control Board (Regional Board) and became effective December 28, 2012. The MS4 Permit was created for the purpose of protecting the beneficial uses in the receiving waters in the Los Angeles County region by ensuring that MS4s in the County of Los Angeles are not causing or contributing to exceedances of applicable water quality objectives. The MS4 Permit allows the permittees to customize their stormwater programs through the development and implementation of an Enhanced Watershed Management Program (EWMP) to achieve compliance with certain receiving water limitations and water quality based effluent limits. Following the adoption of the MS4 Permit, the Cities of Palos Verdes Estates, Rancho Palos Verdes, Rolling Hills Estates, along with the County of Los Angeles (Unincorporated County), and Los Angeles County Flood Control District (LACFCD) began to collaborate on the development of an EWMP to address the water quality priorities for the Palos Verdes Peninsula watersheds. This group of Permittees is referred to as the Palos Verdes Peninsula Watershed Management Group (Peninsula WMG). The Peninsula WMG previously submitted a Notice of Intent (NOI) to develop the Peninsula EWMP. In addition, the Peninsula WMG has been coordinating with other agencies and watershed management groups in the development of this EWMP Work Plan, including the City of Los Angeles, the Dominguez Channel EWMP Group, and the Beach Cities EWMP Group. The Peninsula WMG will continue to coordinate with neighboring WMP/EWMP groups to identify projects that maybe beneficial to each party, where possible.

The MS4 Permit requires that an EWMP Work Plan for the development of the Peninsula EWMP be submitted within 18 months of its effective date (June 28, 2014). This document serves as the Work Plan for the Peninsula WMG, and describes the proposed path to take to complete the Peninsula EWMP process. This Work Plan summarizes efforts undertaken to date and outlines planned efforts that will be undertaken to develop the Peninsula EWMP and address MS4 Permit requirements. The Work Plan is divided into the following five sections:

<u>Section 1</u> – Introduction: Provides the geographical scope, regulatory basis, development process and goals of the Peninsula EWMP.

<u>Section 2</u> – Water Quality Priorities: Defines water quality priorities for the Peninsula EMWP watersheds, describes the water quality characterization of receiving waters to which the Peninsula EWMP watersheds drain, and summarizes the Source Assessment conducted to date.

<u>Section 3</u> – Watershed Control Measures: Summarizes the suite of existing and potential watershed control measures that will be used to address the water quality priorities identified in Section 2 and describes the process for evaluating Regional EWMP projects.

<u>Section 4</u> – Reasonable Assurance Analysis Approach: Provides a description of the modeling approach that will be used to demonstrate reasonable assurance that the watershed control measures identified in the Peninsula EWMP will achieve water quality goals.

[1] California Regional Water Quality Control Board Los Angeles Region. 2012. Order No. R4-2012-0175 NPDES Permit No. CAS004001 Waste Discharge Requirements for Municipal Separate Storm Sewer System (MS4) Discharges within the Coastal Watersheds of Los Angeles County, except those Discharges Originating from the City of Long Beach MS4.

Section 5 – EWMP Development: Provides a summary of next steps and outlines the Peninsula EWMP development schedule.

1.1. Geographic Scope of the Peninsula EWMP

The geographic scope of the Peninsula EWMP is comprised of the incorporated Cities of Rancho Palos Verdes, Palos Verdes Estates and Rolling Hills Estates and unincorporated areas of the County of Los Angeles and LACFCD facilities (See Appendix 1.A for a summary of LACFCD facilities within the Peninsula WMG). The City of Rolling Hills is not participating in the Peninsula EWMP; however, the city is participating in the Peninsula WMG Coordinated Integrated Monitoring Program (CIMP).

The Palos Verdes Peninsula is situated in the southwestern portion of Los Angeles County atop the Palos Verdes Hills, which are bounded to the north by the City of Torrance, to the east by the City of Los Angeles, and to the south and west by the Pacific Ocean. The Peninsula WMG area is divided into two HUC-12 equivalent watersheds: 1) Santa Monica Bay (SMB) Watershed and 2) the Greater Dominguez Channel Watershed Management Area, which is subdivided into two subwatersheds, the Los Angeles Harbor Subwatershed and the Machado Lake Subwatershed. A drainage divide dissects the Peninsula from the northeast to the southwest with the westerly portion draining into Santa Monica Bay and the easterly portion draining to Machado Lake and the Los Angeles Harbor subwatersheds. The SMB Watershed accounts for 63% (14.2 square miles) of the total Peninsula WMG area, and includes portions of the cities of Palos Verdes Estates, Rancho Palos Verdes, and Rolling Hills Estates. The Los Angeles Harbor Subwatershed accounts for 15% (3.4 square miles) of the total Peninsula WMG area, and includes portions of the cities of Rancho Palos Verdes and Rolling Hills Estates. The Machado Lake Subwatershed accounts for 22% (4.9 square miles) of the total Peninsula WMG area, and includes portions of the cities of Palos Verdes Estates, Rancho Palos Verdes, Rolling Hills Estates, and the County of Los Angeles. Drainage from the Peninsula WMG agencies is conveyed via natural soft bottom canyons in conjunction with structured storm drain systems. Table 1-1 provides the Peninsula EWMP area identified by watershed and agency, and Figure 1-1 provides a map of the Peninsula EWMP watershed and jurisdictional boundaries, including existing water quality monitoring sites in the Peninsula EWMP area.

Table 1-1 Jurisdictional Areas within Each Peninsula EWMP Watershed

Permittee	Land Area within Santa Monica Bay Watershed (Square Miles)	Land Area within Machado Lake Subwatershed (Square Miles)	Land Area within Los Angeles Los Angeles Harbor Subwatershed (Square Miles)	Total EWMP Area
Rancho Palos Verdes	9.35	1.07	3.02	**13.5**
Palos Verdes Estates	4.35	0.39	0	**4.8**
Rolling Hills Estates	0.46	2.78	0.34	**3.6**
County of Los Angeles	0	0.70	0	**0.7**
Total	**14.2**	**4.9**	**3.4**	**22.6**

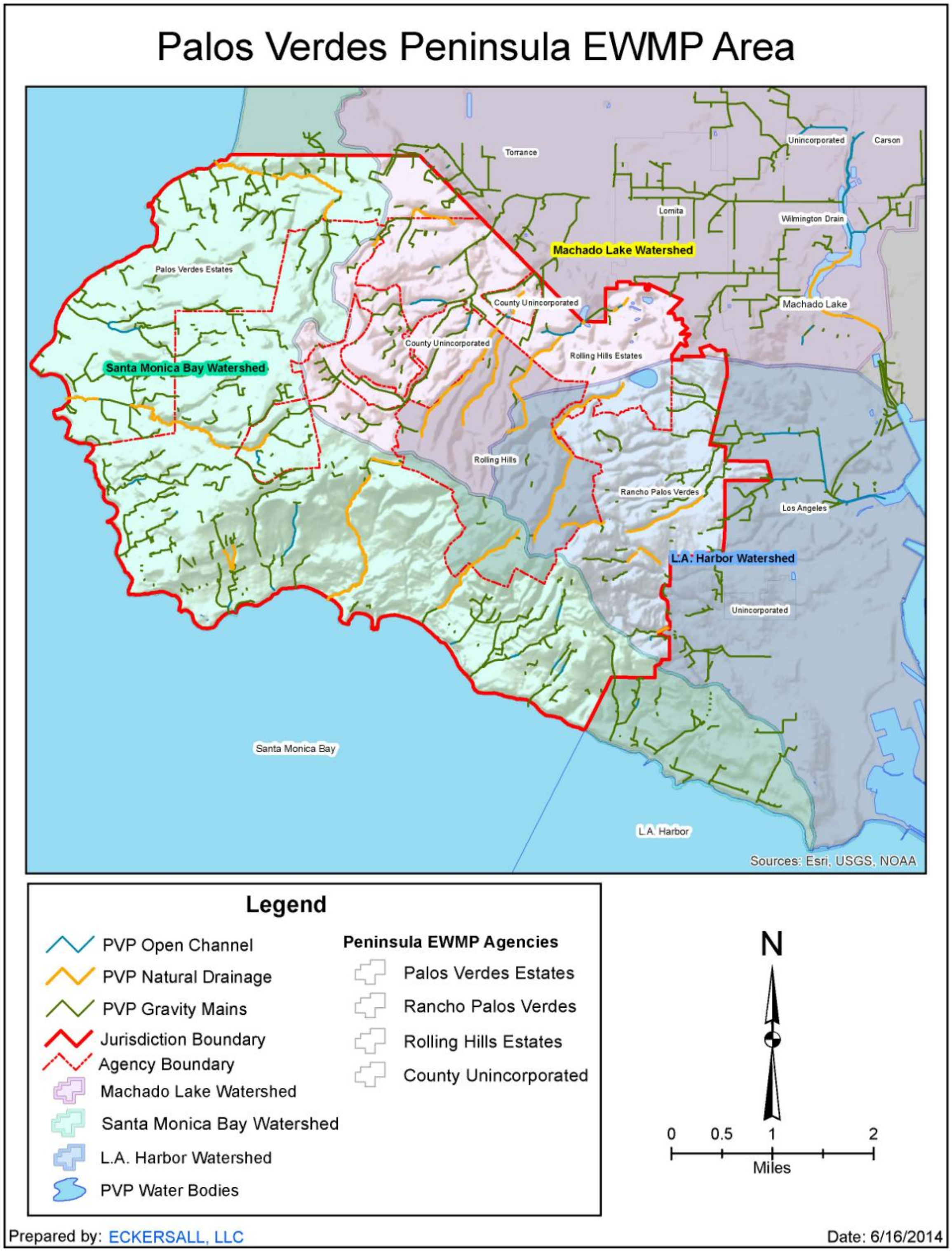

Figure 1-1 Peninsula EWMP Area and Existing Monitoring Locations

1.2. Regulatory Framework

In 1972 the National Pollution Discharge Elimination System (NPDES) was created through Section 402 of the Clean Water Act. NPDES prohibits discharges of pollutants from any point source into the nation's waters except as allowed under an NPDES permit, including the MS4 system. The MS4 system includes curbs and gutters, man-made channels, catch basins and storm drains.

The State Water Resources Control Board (State Board), which is divided into nine Regional Water Quality Control Boards, is responsible for ensuring that counties, cities and other dischargers meet the requirements of the Clean Water Act. To enforce clean water at the local level, municipalities and the County of Los Angeles unincorporated areas are required to obtain a discharge permit from the Regional Board to discharge stormwater, hence the MS4 Permit.

The MS4 Permit includes effluent limitations, receiving water limitations, minimum control measures (MCMs), and TMDL provisions, and outlines the process for developing watershed management programs, including the EWMP. The MS4 Permit also incorporates Total Maximum Daily Loads (TMDLs) for impaired surface waters in Los Angeles County. TMDLs represent the amount of a pollutant that can be released into a waterbody to ensure attainment of water quality standards and protection of the waterbody's beneficial uses.

Development of an EWMP is one of the compliance options outlined in the MS4 Permit to address effluent limitations, receiving water limitations, and TMDLs. The EWMP must also incorporate MCMs, which are programs required to be implemented to address water quality issues.

1.3. EWMP Goals and Development Process

The MS4 Permit defines an EWMP as follows:

> *An EWMP is one that comprehensively evaluates opportunities, within the participating Permittees' collective jurisdictional area in a Watershed Management Area, for collaboration among Permittees and other partners on multi-benefit regional projects that, wherever feasible, retain (i) all non-storm water runoff and (ii) all storm water runoff from the 85th percentile, 24-hour storm event for the drainage areas tributary to the projects, while also achieving other benefits including flood control and water supply, among others. In drainage areas within the EWMP area where retention of the 85th percentile, 24-hour storm event is not feasible, the EWMP shall include a Reasonable Assurance Analysis (RAA) to demonstrate that applicable WQBELs and RWLs shall be achieved through implementation of other watershed control measures. An EWMP shall:*

i. *Be consistent with the provisions in Part VI.C.1.a.-f and VI.C.5-C.8;*
ii. *Incorporate applicable State agency input on priority setting and other key implementation issues;*
iii. *Provide for meeting water quality standards and other CWA obligations by utilizing provisions in the CWA and its implementing regulations, policies and guidance;*
iv. *Include multi-benefit regional projects to ensure that MS4 discharges achieve compliance with all final WQBELs set forth in Part VI.E. and do not cause or contribute to exceedances of receiving water limitations in Part V.A. by retaining through infiltration or capture and reuse the storm water volume from the 85th percentile, 24-hour storm for the drainage areas tributary to the multi-benefit regional projects.;*
v. *In drainage areas where retention of the storm water volume from the 85th percentile, 24-hour event is not technically feasible, include other watershed control measures to ensure*

that MS4 discharges achieve compliance with all interim and final WQBELs set forth in Part VI.E. with compliance deadlines occurring after approval of a EWMP and to ensure that MS4 discharges do not cause or contribute to exceedances of receiving water imitations in Part V.A.;

vi. *Maximize the effectiveness of funds through analysis of alternatives and the selection and sequencing of actions needed to address human health and water quality related challenges and non-compliance;*
vii. *Incorporate effective innovative technologies, approaches and practices, including green infrastructure;*
viii. *Ensure that existing requirements to comply with technology-based effluent limitations and core requirements (e.g., including elimination of non-storm water discharges of pollutants through the MS4, and controls to reduce the discharge of pollutants in storm water to the maximum extent practicable) are not delayed;*
ix. *Ensure that a financial strategy is in place.*

The goal of the Peninsula EWMP is to identify water quality priorities and outline a regional, multi-agency strategy for achieving water quality goals. The Peninsula EWMP Work Plan is the first step in the development of a comprehensive program that will address MS4 Permit requirements and set a path toward achieving these water quality goals. A Reasonable Assurance Analysis (RAA) will be conducted through the use of watershed models during the development of the Peninsula EWMP to ensure that the proposed implementation strategy will achieve applicable water quality objectives.

The Peninsula EWMP will employ a quantitative analysis to select a suite of Watershed Control Measures that will be implemented to address Water Quality Priorities in the Peninsula EWMP watersheds. The following steps describe the EWMP development process (See Figure 1-2):

1. Step 1: Identify water quality priorities. This step entails analyzing existing water quality data, developing categories of waterbody-pollutant combinations that need to be addressed, conducting a source assessment to evaluate potential sources of the identified pollutants, and prioritize the pollutants based on MS4 Permit requirements and the results to the source assessment. This step is described in **Section 2** of this Work Plan.
2. Step 2: Identify and Evaluate Watershed Control Measures. This step entails compiling existing and planned control measures in the Peninsula EWMP watersheds, identifying additional control measures to potentially implement, and evaluating the suite of control measures to determine the most effective strategy for addressing water quality priorities. This step is described in **Section 3** of this Work Plan.
3. Step 3: Conduct Reasonable Assurance Analysis (RAA): This step entails conducting a quantitative analysis of the selected Watershed Control Measures to evaluate their cumulative impact on water quality. This step will also include the development of an implementation schedule for selected control measures. This step is described in **Section 4** of this Work Plan.
4. Step 4: Implement the Coordinated Integrated Monitoring Program: This step entails the implementation of a monitoring program to measure progress toward addressing water quality priorities and meeting scheduled milestones.
5. Step 5: Adaptive Management: This step entails evaluating the EWMP program effectiveness every 2 years and refining the EWMP program to more effectively address water quality priorities based on this evaluation.

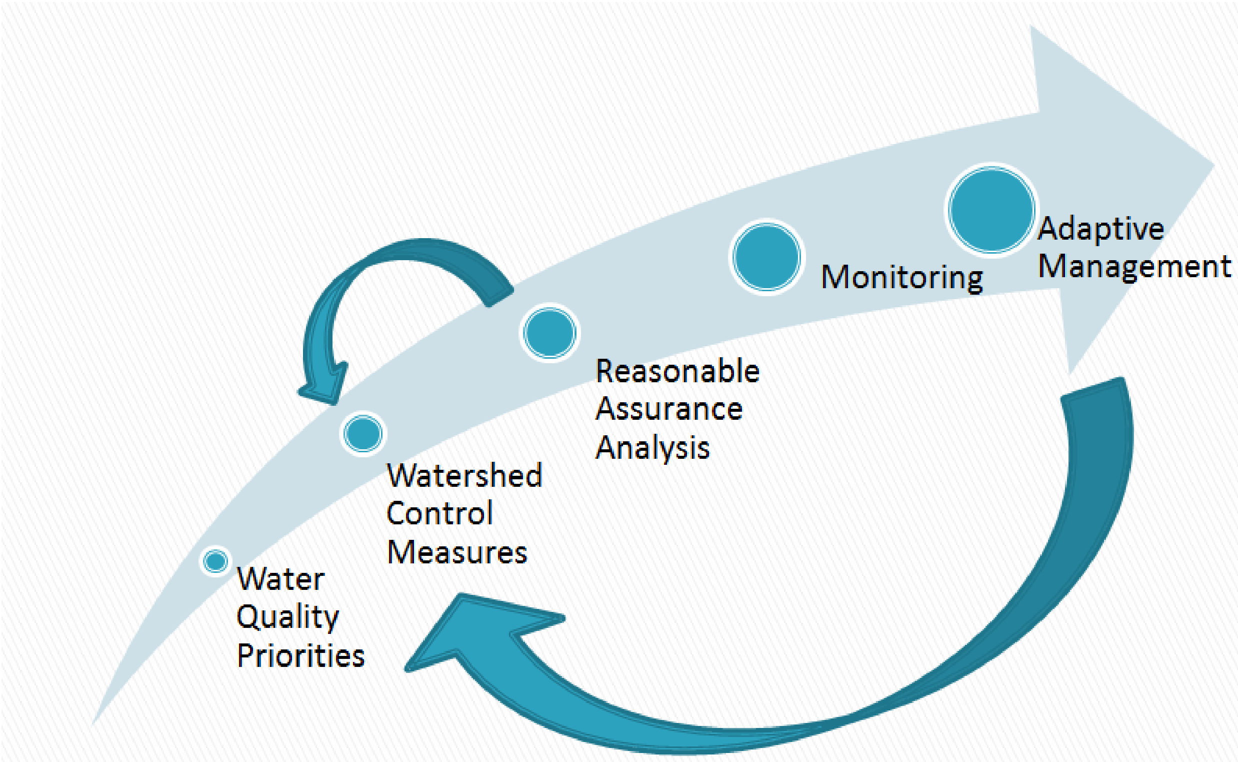

Figure 1-2 EWMP Development Process

2. Water Quality Priorities

The first step in the EWMP development process is to identify Water Quality Priorities. In order to begin prioritizing water quality issues within Peninsula WMG watersheds, an assessment of existing water quality conditions, including characterization of receiving waters and stormwater and non-stormwater discharges from the MS4 has been completed per section VI.C.5.a of the MS4 Permit.

2.1 Water Quality Characterization

In order to characterize existing water quality conditions in the Peninsula EWMP watersheds, and to identify pollutants of concern for prioritization per section VI.C.5.a.ii of the MS4 Permit, available data from TMDLs, the 303(d) list, and available monitoring data collected during the previous ten years were analyzed. The following source documents were utilized during the water quality characterization:

- Basin Plan Amendments
    - Santa Monica Bay Bacteria Dry and Wet Weather TMDLs
    - Santa Monica Bay Marine Debris TMDL
    - Santa Monica Bay DDT and PCBs TMDL
    - Machado Lake Trash TMDL
    - Machado Lake Pesticides and PCBs TMDL
    - Machado Lake Nutrient TMDL
    - Long Beach and Greater Los Angeles Harbor Toxics TMDL[2]
- Monitoring Reports and Data
    - Port of Los Angeles Ambient Water Quality Monitoring Data (2005-2008)
    - Southern California Coastal Water Research Project (SCCWRP) Bight Study (2008)
    - City of Los Angeles Machado Lake Nutrient TMDL Monitoring Data (2011-2012)
    - County of Los Angeles Machado Lake Nutrient TMDL Monitoring Data (2012)
    - Palos Verdes Peninsula Coordinated Machado Lake Nutrient TMDL Monitoring Data (2011-2012)
    - Los Angeles County Sanitation Districts Santa Monica Bay Bacteria TMDL Monitoring Data (2003-2013)
    - Los Angeles County 1994-2000 Integrated Receiving Water Impacts Report

2.1.1 Summary of Existing TMDLs and Deadlines

TMDLs assign load allocations (LAs) and waste load allocations (WLAs) to dischargers of a pollutant to ensure that the total amount of that pollutant entering a receiving waterbody will not impair its beneficial uses. The Regional Board is required to incorporate compliance schedules into TMDLs. Applicable TMDL compliance dates were used to identify and classify Peninsula WMG pollutants as Category 1: Highest Priority Pollutants (see **Section 2.2: Waterbody Pollutant Categorization**). Table 2-1

[2] As recognized by the footnote in Attachment K-4 of the MS4 Permit, the Peninsula WMG members have entered into an Amended Consent Decree with the United States and the State of California, including the Regional Board, pursuant to which the Regional Board has released the Peninsula WMG members from responsibility for Toxic pollutants in the Dominguez Channel and the Greater Los Angeles and Long Beach Harbors. Accordingly, no inference should be drawn from the submission of this EWMP Work Plan or from any action or implementation taken pursuant to it that the Peninsula WMG members are obligated to implement the DC Toxics TMDL, including this EWMP Work Plan or any of the DC Toxics TMDL's other obligations or plans, or that the Peninsula WMG has waived any rights under the Amended Consent Decree.

shows existing TMDLs applicable to the Peninsula EWMP and Table 2-2 shows existing TMDL interim and final compliance dates.

Table 2-1 TMDLs Applicable to the Peninsula EWMP

TMDL	Regional Board Resolution Number	Effective Date and/or Environmental Protection Agency (EPA) Approval Date
Santa Monica Bay Beaches Wet Weather Bacteria TMDL – Group 7	2002-022 Amended by R12-007	July 15, 2003 R12-007 not yet effective
Santa Monica Bay Beaches Dry Weather Bacteria TMDL – Group 7	2002-004 Amended by R12-007	July 15, 2003 R12-007 not yet effective
Santa Monica Bay Nearshore and Offshore Debris TMDL	R10-010	March 20, 2012
Machado Lake Trash TMDL	2007-006	March 6, 2008
Machado Lake Nutrient TMDL	2008-006	March 11, 2009
Machado Lake Pesticides and PCBs (Toxics) TMDL	R10-008	March 20, 2012
Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxic Pollutants TMDL	R11-008	March 23, 2012
Santa Monica Bay TMDL for DDTs and PCBs	EPA Established	March 26, 2012

Table 2-2 TMDL Compliance Dates Applicable to the Peninsula EWMP

TMDL	Segments	Constituents	Compliance Goal	Weather Condition	Compliance Dates and Compliance Milestones									
					2012	2013	2014	2015	2016	2017*	2018	2019	2020	2032
Santa Monica Bay Beaches Bacteria	Abalone Cove Bluff Cove Inspiration Point Long Point Malaga Cove Portuguese Bend	Total Coliform Fecal Coliform Enterococcus	Compliance with Total Allowable Exceedance Days	Winter Dry	Pre 2012									
					Final									
				Summer Dry	Pre 2012									
					Final									
				Wet		Pre 2013								
						Final								
Santa Monica Bay Nearshore and Offshore Debris	All	Trash Plastic Pellets	% Reduction in Trash from Baseline	Wet and Dry					3/20	3/20	3/20	3/20	3/20	
									20%	40%	60%	80%	100%	
Santa Monica Bay DDT &PCBs	Abalone Cove Bluff Cove Inspiration Point Long Point Malaga Cove Portuguese Bend	DDT PCBs	Meet WLAs	Wet and Dry	USEPA Established TMDL – No Implementation Schedule									
Machado Lake Trash	All	Trash	% Reduction in Trash from Baseline	Wet and Dry	3/6	3/6	3/6	3/6	3/6					
					20%	40%	60%	80%	100%					
Machado Lake Pesticides and PCBs	All	Chlordane Dieldrin PCBs DDT	Meet WLAs	Wet and Dry								9/30		
												Final		

TMDL	Segments	Constituents	Compliance Goal	Weather Condition	Compliance Dates and Compliance Milestones									
					2012	2013	2014	2015	2016	**2017***	2018	2019	2020	2032
Machado Lake Nutrient	All	Algae Total Nitrogen Total Phosphorus Ammonia Chlorophyll a Dissolved Oxygen Odor	Meet WLA	Wet and Dry			3/11 Interim				9/11 Final			
Long Beach and Los Angeles Harbor Toxics	Inner Harbor Fish Harbor Cabrillo Marina Outer Harbor	DDT PCBs Copper Lead Zinc Mercury PAHs Chlordane	Meet WLA	Wet and Dry	3/23 Interim									3/23 Final

***RED indicates the end of the MS4 Permit term**

2.1.2 Summary of Existing 303(d) Listings

The State 303(d) list was used to identify and classify Category 2: High Priority Pollutants (see **Section 2.2: Waterbody Pollutant Categorization**). Table 2-3 below summarizes waterbody pollutant combinations identified on the 2010 303(d) list that have not been addressed by a TMDL and provides notes on the status of these listings.

Table 2-3 303(d) Listed Pollutants in Peninsula EWMP Watersheds

Constituent	Waterbody	Notes
Chem A (Tissue)	Machado Lake	Chem A (the abbreviation for 'chemical group A') is a suite of bio-accumulative pesticides that includes chlordane and dieldrin. The 1998 303(d) listing (and subsequent listings) for Chem A was predominately based on fish tissue concentrations of chlordane and dieldrin; there was only minimal detection of other Chem A pollutants in 1983 and 1984. Chlordane and dieldrin have been recently detected in fish tissue, while other Chem A pollutants have not been detected in 25 years. Therefore, the ML Toxics TMDL addresses the Chem A pollutants (chlordane and dieldrin) that are causing this impairment[3].
Pesticides	Palos Verdes Shoreline Point	Palos Verdes Shoreline Point Beach pesticides listing in the consent decree between the USEPA, the Santa Monica BayKeeper and Heal the Bay Inc., represented by the Natural Resources Defense Council (NRDC) is a clerical error and should reflect DDT and PCBs and fish advisory. The 1996 Water Quality Assessment and documentation clearly identified Palos Verdes Shoreline Park Beach as being impaired due to advisories (PCBs, DDTs). This was reflected in the 1996 305(b) report but not the 1996 303(d) report. The omission of this waterbody from the 303(d) report was rectified in the 1998 report but due to a clerical error the listing was renamed pesticides even though the underlying basis of the listing was clearly the DDT and PCBs fish advisory. In fact all the beach listings for DDT and PCBs under AU 58 were based solely on the fish advisories for Santa Monica Bay and are being addressed through the Santa Monica Bay DDT and PCBs TMDL[4].
Sediment Toxicity	Santa Monica Bay Nearshore/Offshore	USEPA has determined that a TMDL is not required for the Santa Monica Bay sediment toxicity listing. This determination is based on lack of toxicity in regional surveys (1994, 1998, 2003, and 2008)[5].

[3] Machado Lake Pesticides and PCBs TMDL
[4] The basis for this finding is described in Section 1.1 Regulatory Background of the USEPA: Santa Monica Bay DDT and PCBs TMDL
[5] The basis for this finding is described in Section 2.2.4 of the USEPA: Santa Monica Bay DDT and PCBs TMDL

Constituent	Waterbody	Notes
Copper	Wilmington Drain	A September 2010 modification of the consent decree between the USEPA, the Santa Monica BayKeeper and Heal the Bay Inc., represented by the Natural Resources Defense Council (NRDC) included a finding of non-impairment for copper and lead in Wilmington Drain. No water quality data are currently available for the Wilmington Drain; however, the Regional Water Resources Control Board has indicated that the impairments for copper and lead will be removed from the 303(d) list when sufficient data is available to de-list in accordance with the State Listing Policy[6].
Lead	Wilmington Drain	
Coliform Bacteria	Wilmington Drain	N/A

2.1.3 Receiving Water Characterization

The Peninsula WMG area drains to one of three subwatersheds as described in **Section 1.1 Geographic Scope of the Peninsula EWMP**. Existing water quality was evaluated for each of these subwatersheds in order to place necessary pollutants into Category 3. In order to characterize the receiving waters to which the Peninsula WMG drains, available monitoring data from the past ten years was analyzed. This section is divided by subwatershed, with a summary of each receiving waterbody's existing water quality.

The beneficial uses of the EWMP WMG receiving waters as designated in the Basin Plan are summarized in Table 2-4. The beneficial use acronyms used below are defined as follows:

- MUN (Municipal and Domestic Supply): *Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply.*
- IND (Industrial Service Supply): *Uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well re-pressurization.*
- NAV (Navigation): *Uses of water for shipping, travel, or other transportation by private, military, or commercial vessels.*
- REC1 (Water Contact Recreation): *Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white water activities, fishing, or use of natural hot springs.*
- REC2 (Non-Contact Water Recreation): *Uses of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.*
- COMM (Commercial and Sport Fishing): *Uses of water for commercial or recreational collection of fish, shellfish, or other organisms including, but not limited to, uses involving organisms*

[6] Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxic Pollutants TMDL

intended for human consumption or bait purposes. MAR (Marine Habitat): *Uses of water that support marine ecosystems including, but not limited to, preservation or enhancement of marine habitats, vegetation such as kelp, fish, shellfish, or wildlife (e.g., marine mammals, shorebirds).*

- WILD (Wildlife Habitat): *Uses of water that support terrestrial ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.*
- BIOL (Preservation of Biological Habitats): *Uses of water that support designated areas or habitats, such as Areas of Special Biological Significance (ASBS), established refuges, parks, sanctuaries, ecological reserves, or other areas where the preservation or enhancement of natural resources requires special protection.*
- RARE (Rare, Threatened, or Endangered Species): *Uses of water that support habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under state or federal law as rare, threatened, or endangered.*
- MIGR (Migration of Aquatic Organisms): *Uses of water that support habitats necessary for migration, acclimatization between fresh and salt water, or other temporary activities by aquatic organisms, such as anadromous fish.*
- SPWN (Spawning, Reproduction, and/or Early Development): *Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.*
- SHELL (Shellfish Harvesting): *Uses of water that support habitats suitable for the collection of filter-feeding shellfish (e.g., clams, oysters, and mussels) for human consumption, commercial, or sports purposes.*
- WARM (Warm Freshwater Habitat): *Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.*
- WET (Wetland Habitat): *Uses of water that support wetland ecosystems, including, but not limited to, preservation or enhancement of wetland habitats, vegetation, fish, shellfish, or wildlife, and other unique wetland functions which enhance water quality, such as providing flood and erosion control, stream bank stabilization, and filtration and purification of naturally occurring contaminants.*

Table 2-4 Peninsula EWMP Area Water Bodies and Beneficial Uses Designated in the Basin Plan

Water Body	MUN	IND	GWR	NAV	COMM	REC1	REC2	WARM	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET[a]
Los Angeles Coastal		E		E												
Santa Monica Bay Nearshore^		E		E	E	E	E		E	E	E	E[e]	E[f]	E[f]	E	
Machado Lake	P*					E	E	E		E		E				E
Los Angeles/Long Beach Harbor																
Inner Harbor		E		E	E	E	E		E			E[e]			P	
Fish Harbor		E		E	E	E	E		E			E			P	
Outer Harbor				E	E	E	E		E			E			P	

E = Existing beneficial use

P = Potential beneficial use

*Asterisked MUN designations are designated under SB 88-63 and RB 89-03. Some designations may be considered for exemption at a later date.

[a] Water bodies designated as WET may have wetlands habitat associated with only a portion of the water body. Any regulatory action would require a detailed analysis of the area.

^Nearshore is defined as the zone bounded by the shoreline or the 30-foot depth contours, whichever is further from the shoreline. Longshore extent is from Rincon Creek to the San Gabriel River Estuary.

[e] = One or more rare species utilizes all ocean, bays, estuaries, and coastal wetlands for foraging and/or nesting.

[f] = Aquatic organisms utilize all bays, estuaries, lagoons, and coastal wetlands, to a certain extent, for spawning and early development. This may include migration into areas which are heavily influenced by freshwater inputs.

2.1.3.1 Santa Monica Bay

All of the agencies that comprise the Peninsula WMG, with the exception of the Unincorporated County, have areas that drain directly to the Santa Monica Bay. The portion of the Peninsula WMG which drains to Santa Monica Bay consists of approximately 14 square miles, which is about 3.4% of the Santa Monica Bay Watershed (414 sq. mi.). The Santa Monica Bay is impaired for DDT, PCBs, marine debris, and bacteria.

2.1.3.2 Bacteria

The Santa Monica Bay Beaches (SMB Beaches) were designated as impaired due to coliform bacteria and included on California's 1998 Clean Water Act (CWA) 303(d) list of impaired waters. The Regional Board issued the SMB Beaches Bacteria TMDLs (for wet and dry weather), which both became effective on July 15, 2003. To meet the requirements of these TMDLs, a SMB Beaches Bacteria TMDLs Coordinated Shoreline Monitoring Plan (CSMP) was developed by a committee of responsible agencies, including representatives from the Peninsula WMG.

Since 2003, five CSMP sites have been sampled for indicator bacteria along the Palos Verdes Peninsula shoreline by the Los Angeles County Sanitation District (LACSD). The five CSMP sites include SMB 7-1 through 7-5 and are shown on Figure 2-1.

The TMDLs establish multi-part numeric targets based on three bacteriological parameters: Total coliform density, fecal coliform density and enterococcus density, measured in MPN/100mL. Since 2005, each site has been monitored on a weekly basis unless there is an exceedance event. On the second day following an exceedance of the water quality objectives for one or more of the bacterial parameters (Table 2-5), an additional sample is taken at the site with the exceedance. To implement the single sample bacteria objectives, and to set waste load allocations (WLAs) based on the single sample targets, the Regional Board set an allowable number of exceedance days at each shoreline monitoring site. In addition, the TMDLs divide the calendar year into three separate periods for compliance purposes, each with specific requirements. The three compliance periods are as follows:

- Summer dry-weather (April 1 – October 31),
- Winter dry weather (November 1 – March 31), and
- Wet weather

Table 2-5 shows the single sample water quality targets for the three indicator bacteria used to determine compliance, and Table 2-6 presents the allowable number of exceedance days at each monitoring location along the Peninsula WMG shoreline. Data collected from the CSMP are summarized in Tables 2-7 and 2-8 below. Although there are some exceedances above the allowable exceedance days, they are infrequent (in most cases less than 3 out of 12 years have exceedance days above the allowable limit). In addition, when beach investigations have been conducted, there is no data to indicate these exceedances were caused by contributions from the MS3. The Peninsula WMG monitoring sites historically experience fewer exceedance days than the reference beach (Leo Carrillo) used in the TMDL, and are therefore in an anti-degradation condition[7].

[7] The antidegradation policy applies to waters that are determined to have high water quality and requires that existing high quality be maintained.

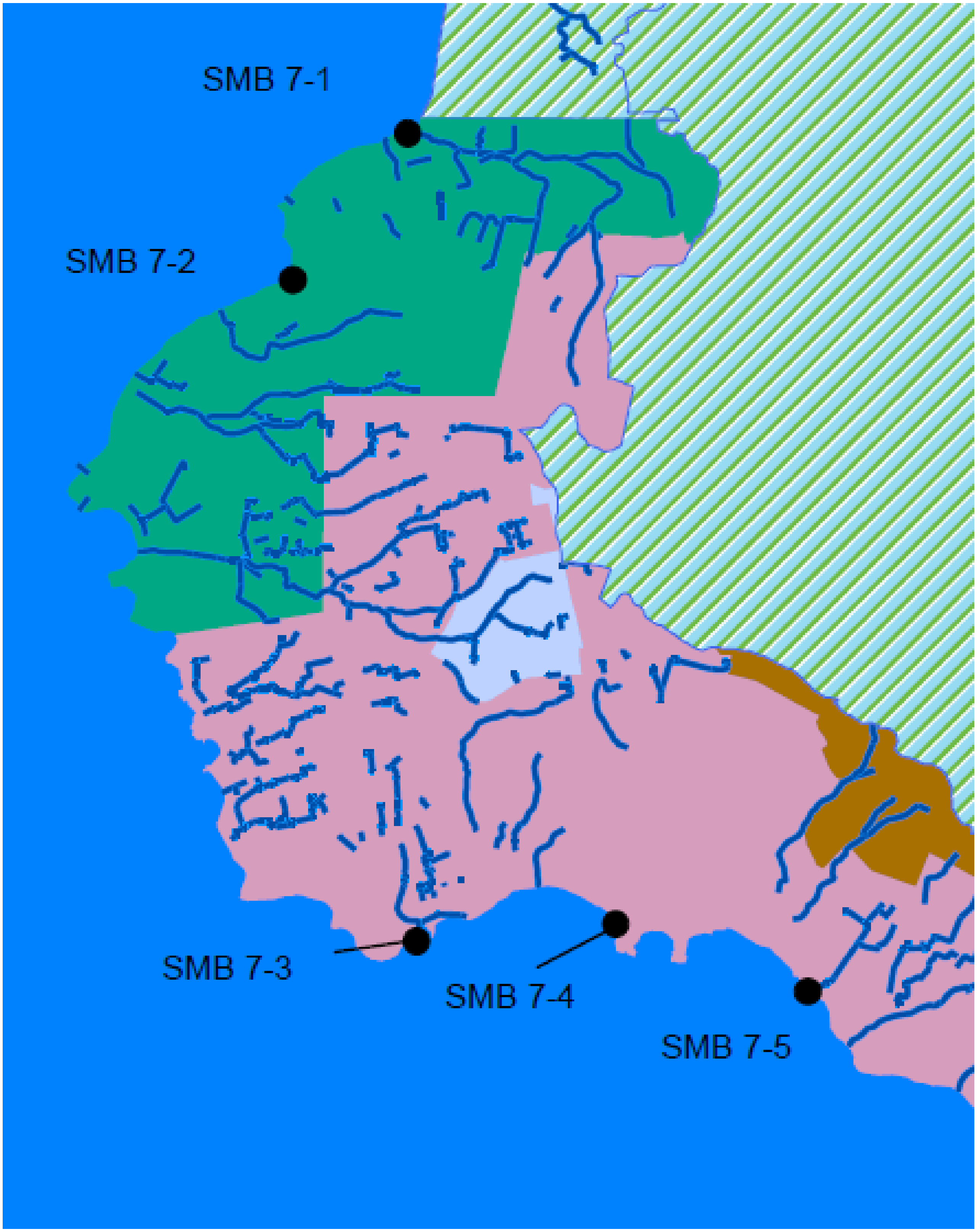

Figure 2-1 Santa Monica Bay Bacteria Monitoring Stations within the Peninsula EWMP area

Table 2-5 Single Sample Compliance Targets[8]

Constituent	Rolling 30-day Geometric Mean Limit	Single Sample Limits
Total Coliform*	1,000/100 mL	10,000/100 mL
Fecal Coliform	200/100 mL	400/100 mL
Enterococcus	35/100 mL	104/100 mL

Table 2-6 Allowable Exceedance Days[(a)] **per Monitoring Location**[9]

Sampling Location	Winter Dry Weather Exceedance Days allowed[(b)]	Summer Dry Weather Exceedance Days allowed[(c)]	Wet Weather [(d)] Exceedance Days Allowed[(e)]
SMB 7-1 (Malaga Cove)	1	0	2
SMB 7-2 (Bluff Cove)	1	0	0
SMB 7-3 (Long Point)	1	0	1
SMB 7-4 (Abalone Cove)	0	0	1
SMB 7-5 (Portuguese Bend Cove)	1	0	1

(a) Allowable Exceedance days based on weekly sampling
(b) Final compliance beginning July 15, 2009
(c) Final compliance beginning July 15, 2006
(d) Wet weather days are those days with rain events of ≥ 0.1 inches of precipitation and the three days following the end of the rain event.
(e) Final compliance beginning July 15, 2013

[8] City of Los Angeles and County of Los Angeles, Technical Steering Committee: Santa Monica Bay Beaches Bacterial TMDLs Coordinated Shoreline Monitoring Plan
[9] Ibid.

Table 2-7 Number of Exceedance Days per Calendar Year by Monitoring Site and Compliance Period

		SMB 7-1	SMB 7-2	SMB 7-3	SMB 7-4	SMB 7-5
2003	Wet Weather	1	0	1	0	0
	Dry Summer	1	0	1	0	0
	Dry Winter	1	0	0	0	0
2004	Wet Weather	1	2	3	2	2
	Dry Summer	2	1	0	0	2
	Dry Winter	1	1	0	0	0
2005	Wet Weather	3	1	8	4	3
	Dry Summer	0	0	0	1	0
	Dry Winter	0	0	0	0	3
2006	Wet Weather	1	0	2	0	1
	Dry Summer	0	0	0	0	0
	Dry Winter	1	0	0	0	0
2007	Wet Weather	0	0	0	0	0
	Dry Summer	0	0	0	0	0
	Dry Winter	0	0	0	0	0
2008	Wet Weather	1	0	0	0	0
	Dry Summer	0	0	0	0	0
	Dry Winter	0	0	0	0	1
2009	Wet Weather	1	0	1	0	1
	Dry Summer	0	0	0	0	1
	Dry Winter	0	0	0	1	0
2010	Wet Weather	1	0	0	3	3
	Dry Summer	0	0	1	0	0
	Dry Winter	0	0	0	0	0
2011	Wet Weather	0	0	0	0	0
	Dry Summer	2	0	0	0	2
	Dry Winter	0	0	1	0	0
2012	Wet Weather	0	0	0	0	0
	Dry Summer	0	0	1	0	0
	Dry Winter	0	0	2	0	0
2013	Wet Weather	0	0	0	0	0
	Dry Summer	0	1	1	0	0
	Dry Winter	0	0	2	0	0
2014*	Wet Weather	0	0	0	0	0
	Dry Summer	0	0	0	0	0
	Dry Winter	0	0	0	0	0

**Source: LACSD; Data collected through 2/25/2014*

Table 2-8 Percentage of Calendar Years in Compliance with Allowable Exceedance Days by Compliance Period

	Percentage of Years in Compliance with Allowable Exceedance Days for Winter Dry Weather*	Percentage of Years in Compliance with Allowable Exceedance Days for Summer Dry Weather*	Percentage of Years in Compliance with Allowable Exceedance Days for Wet Weather*
SMB 7-1	100%	92%	100%
SMB 7-2	100%	100%	100%
SMB 7-3	83%	75%	100%
SMB 7-4	100%	100%	100%
SMB 7-5	100%	83%	100%

*Data analyzed from 1/1/2003 - 2/25/2014. Exceedance days occurring before final compliance deadlines were considered in compliance.

2.1.3.3 PCBs and DDT

Concentrations of DDT and PCBs in the surface sediments of the Santa Monica Bay have decreased substantially since the early 1970s; however, they are still present at levels of concern for bioaccumulation and human health[10]. The MS4 Permit requires routine stormwater sampling at mass emissions stations throughout LA County. Sampling is conducted by the Los Angeles County Department of Public Works, and typically includes four wet-weather events and four dry-weather events per year at these mass emission stations. In the Santa Monica Bay Watershed, the Ballona Creek and Malibu Creek mass emission stations are the two closest to the Peninsula EWMP area. Neither of these stations has detected DDT or PCBs since the mid-90s[11].

The US EPA issued the Santa Monica Bay DDT and PCBs TMDL in 2012. In order to estimate stormwater loading of these pollutants to the Santa Monica Bay, a study by Curren et al. (2011) was used along with data collected by the City of Los Angeles from 2007-2010. Estimated stormwater loads from Santa Monica Bay watersheds were found to be lower than TMDL calculated allowable loads to achieve sediment targets; therefore, the waste load allocations for DDT and PCBs are based on existing load estimates, and the MS4 dischargers are essentially in an anti-degradation condition[12].

The Peninsula EWMP area drains to the Palos Verdes Shelf portion of Santa Monica Bay, which is an active EPA Superfund site that is subject to Superfund Remedial Action Objectives (RAOs)[13]. These RAOs include institutional controls, natural recovery, capping, and monitored attenuation, and are expected to result in improved water quality and compliance with EPA established numeric targets for DDT and PCBs in the Santa Monica Bay.

[10] USEPA: Santa Monica Bay DDT and PCBs TMDL

[11] According to the Santa Monica Bay DDT and PCBs TMDL, there were no detectable concentrations of DDT in stormwater samples from 1994 to 2005 (LADPW, 2005). Similar results were found for DDT in Malibu (1997 to 2005); Los Angeles Department of Public Works (LADPW) has not indicated detectable levels of PCBs in stormwater from Ballona or Malibu since the mid 1990s. The detection levels used in the LA County Mass Emission sampling are 2 & 3 orders of magnitude larger than the California Ocean Plan human health criteria for DDT and PCBs respectively.

[12] USEPA: Santa Monica Bay DDT and PCBs TMDL

[13] Ibid.

2.1.3.4 Marine Debris

The 1998, 2002, and 2006 303(d) lists include debris as an impairment to beneficial uses in the Santa Monica Bay. On October 16, 2008 and August 10, 2009, Regional Board staff conducted site visits along the beaches in the southern and northern parts of the Santa Monica Bay, respectively, to document the trash problem, and subsequently issued the Santa Monica Bay Nearshore and Offshore Marine Debris TMDL, which went into effect on Mar 20, 2012. Compliance with the Santa Monica Bay Debris TMDL is based on installation of structural best management practices such as full capture or partial capture systems, institutional controls, or any best management practices, to attain a progressive reduction in the amount of trash in the Santa Monica Bay[14]. The agencies within the Peninsula WMG have chosen to comply through the installation of full capture devices in catch basins draining to Santa Monica Bay. These devices are being installed in accordance with the compliance schedule outlined in the TMDL.

2.1.3.5 Machado Lake

The Peninsula WMG areas do not drain directly into Machado Lake. Drainage from the Peninsula WMG areas exit the Peninsula in an easterly or northeasterly direction where it is comingled with drainage from the cities of Torrance and Lomita prior to flowing into three of the four major drainage systems entering Machado Lake (Wilmington Drain, Project 77 and Project 510). The portion of the Peninsula WMG which contributes runoff to Machado Lake consists of approximately 5 square miles, which is about 22% of the Machado Lake Subwatershed drainage area (approximately 22.6 sq. mi. total). Machado Lake is impaired for toxics, nutrients, and trash.

Over 80% of the Machado Lake Subwatershed drains to Machado Lake through Wilmington Drain. The Peninsula WMG agencies contribute runoff to the Wilmington Drain, Project 77, and Project 510 storm drain lines (Figure 2-2). Wilmington Drain is listed on the State’s 303(d) List for copper, lead and coliform bacteria. However, the Regional Board has indicated non-impairment for copper and lead, and these constituents will be removed from the 303(d) list when sufficient data is available to de-list in accordance with the State Listing Policy[15].

[14] Santa Monica Bay Nearshore and Offshore Marine Debris TMDL
[15] Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxic Pollutants TMDL

Figure 2-2: Storm Drains Entering Machado Lake (*Source: City of Los Angeles Machado Lake Nutrient TMDL Annual Report*)

a. Nutrients

Machado Lake is identified on the State's 303(d) list of impaired water bodies due to eutrophic conditions, algae, ammonia, and odors. These impairments are caused by excessive loading of nutrients, including nitrogen and phosphorus, to the lake. To address these impairments, the Regional Board issued the Machado Lake Eutrophic, Algae, Ammonia, and Odors (Nutrient) TMDL, which became effective March 11, 2009.

In 2011, the City of LA commenced a nutrient monitoring program in Machado Lake in compliance with the Machado Lake Nutrient TMDL. Water samples are collected bi-weekly from two monitoring sites (ML-1 and ML-2) located in the open water portion of the lake, one at the northern end and one at the southern end (Figure 2-3). In addition, in-situ parameters are measured at the time of sample collection. Sampling results are averaged from the two sampling locations when assessing compliance with the load allocations (LAs) and attainment of numeric targets[16].

In 2011, monthly average concentrations of total nitrogen were in compliance with the 1st interim limit of 3.50 mg/L, and total phosphorus had two exceedances of the 1st interim limit of 1.25 mg/L. These exceedances occurred during the summer months of July and August. Ammonia did not exceed the final numeric target of 2.15 mg/L in any sample. The final numeric target for Chlorophyll-a (20 µg/L, monthly average) was exceeded in the months of June, July, August and September with the average concentrations of 22.0 µg/L, 48.5 µg/L, 81.5 µg/L and 29.75 µg/L, respectively. Chlorophyll-a concentration varied greatly with lake depth. In 2012, total nitrogen and total phosphorus concentrations were all in compliance with the 1st interim WLA[17]. Table 2-9 presents numeric targets and interim and final WLAs and LAs for Machado Lake.

[16] City of Los Angeles Bureau of Sanitation Watershed Protection Division: Machado Lake Nutrients TMDL Annual Report 2011 (#240)

[17] City of Los Angeles Bureau of Sanitation Watershed Protection Division: Machado Lake Nutrients TMDL Annual Reports 2011 and 2012 (#240 and #241)

Figure 2-3 Machado Lake Monitoring Stations

Table 2-9 Nutrient TMDL Numeric Targets and Load Allocations for Machado Lake

Compliance Date	Numeric Target	WLAs and LAs (Average Concentration)
March 11, 2009 (1st Interim)		Total Phosphorus: 1.25 mg/L Total Nitrogen: 3.5 mg/L
March 11, 2014 (2nd Interim)		Total Phosphorus: 1.25 mg/L Total Nitrogen: 2.45 mg/L
September 11, 2018 (Final)	Total Phosphorus 0.1 mg/L (monthly average) Total Nitrogen: 1.0 mg/L (monthly average) Ammonia 5.95 mg/L (hourly average) 2.15 mg/L (30-day average) Dissolved Oxygen* 5 mg/L (single sample minimum) *Measured at 0.3-m above the sediment) Chlorophyll-*a* 20 µg/L (monthly average)	Total Phosphorus: 0.1 mg/L Total Nitrogen: 1.0 mg/L

a. Toxics

Machado Lake is identified on the State's 1998, 2002, 2006, and 2008 Clean Water Act 303(d) lists of impaired water bodies as impaired due to chlordane, DDT, dieldrin, Chem A, and PCBs in tissue[18]. The Machado Lake Pesticides and PCBs TMDL was issued to address these impairments and became effective March 20, 2012. The Peninsula WMG will address these constituents in the Peninsula EWMP and CIMP.

b. Trash

Machado Lake is identified on the State's 1996, 1998, and 2002 Clean Water Act 303(d) lists of impaired water bodies as impaired due to trash[19]. Consequently, the Regional Board issued the Machado Lake Trash TMDL, which became effective March 6, 2008. There are two alternatives for responsible jurisdictions to achieve compliance with waste load allocations in the Machado Lake Trash TMDL, either implement full capture systems or implement a Minimum Frequency of Assessment and Collection (MFAC) program. The agencies within the Peninsula WMG have chosen to comply through the installation of full capture devices in catch basins draining to Machado Lake. These devices are being installed in accordance with the compliance schedule outlined in the TMDL.

[18] Machado Lake Pesticides and PCBs TMDL
[19] Machado Lake Trash TMDL

2.1.3.6 Greater Los Angeles Harbor

The Peninsula WMG areas do not drain directly into the Greater Los Angeles Harbor. Drainage from the Peninsula EWMP area exits the cities of Rancho Palos Verdes and Rolling Hills Estates in an easterly or southeasterly direction and becomes comingled with discharge from the City of LA. The portion of the Peninsula EWMP area which contributes runoff to Greater Los Angeles Harbor consists of approximately 3.4 square miles, which is about 2.6% of the Dominguez Channel Watershed Management Area (approximately 133 sq. mi. total) that drains to the Los Angeles Harbor[20]. Specific Los Angeles Harbor water segments to which the Peninsula WMG contributes runoff include the Inner and Outer Harbor, Fish Harbor, and Cabrillo Marina (Figure 2-4). These segments are impaired by heavy metals and organic pollutants including copper, mercury, lead, zinc, chlordane, and certain Polycyclic Aromatic Hydrocarbons (PAH) compounds. These impairments exist in the water, sediments and fish tissue within the Los Angeles Harbor waters. Fish consumption advisories also currently exist for DDT and PCBs in certain fish species in all of the Los Angeles Harbor waters.

Water quality data was unavailable during the development of this Work Plan; however, reports summarizing monitoring efforts in Los Angeles Harbor waters were reviewed. The most recent water quality collection efforts in the Los Angeles Harbor water segments collecting drainage from the Peninsula EWMP area are summarized below.

[20] Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxic Pollutants TMDL

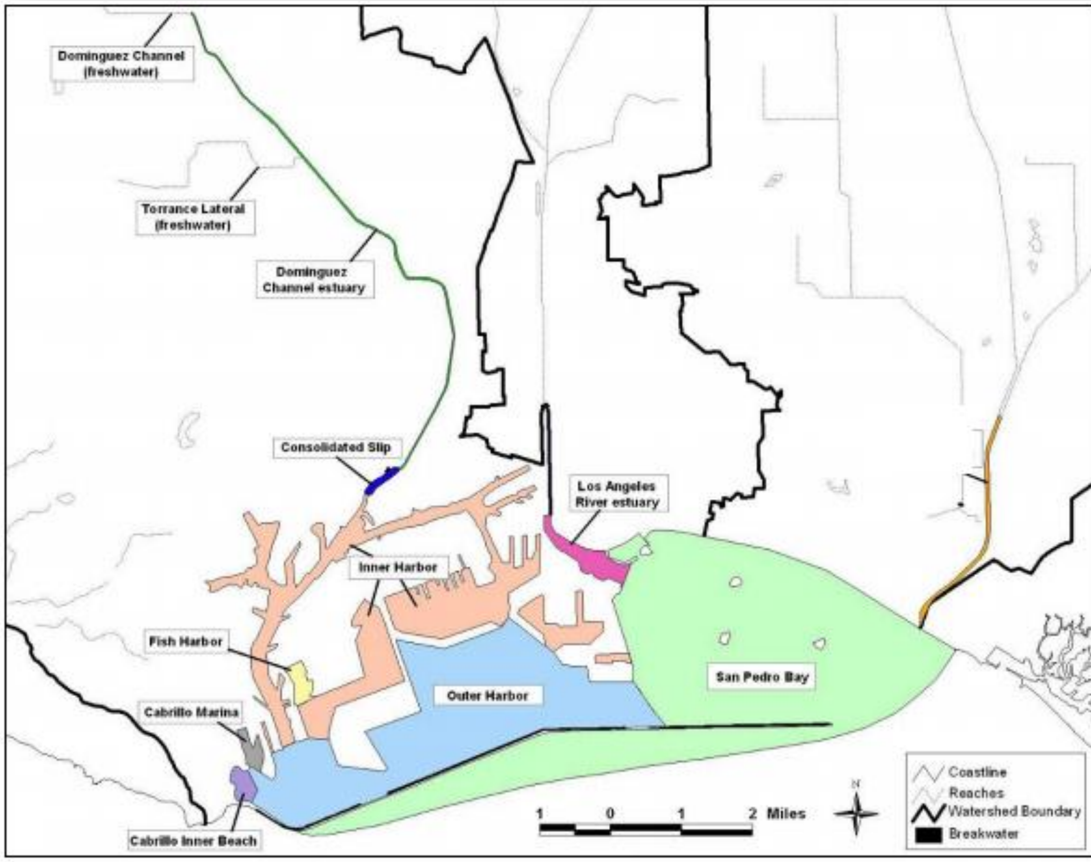

Figure 2-4 Dominguez Channel and Greater LA and Long Beach Harbor Waters

a. *Port of Los Angeles (POLA)/Port of Long Beach (POLB) Water Quality Sediment Toxicity*

In 2005, the Los Angeles and Long Beach Harbors initiated enhanced ambient water quality monitoring programs at 30 open-water sampling stations throughout the harbors. Seven monitoring events were conducted from 2005-2008, during which POLA collected mid-water column samples at a minimum of 30 locations. Figure 2-5 shows the locations of the harbor-wide monitoring stations. The seven collection events took place at different times during the year, and included dry and wet weather sampling.

Three samples in the 2005 – 2008 survey exceeded California Toxics Rule (CTR) water quality criteria for dissolved copper in POLA waters: two samples in the Cabrillo Marina region and one sample in Fish Harbor exceeded the CTR chronic criteria of 3.1 ppb, and the concentration in one sample from the Cabrillo Marina (9.91ppb) was over twice the CTR acute criteria of 4.8 ppb[21]. For most other metals, maximum concentrations throughout the harbor complex were within the CTR chronic criterion for that metal during the course of the study. Cabrillo Marina and Fish Harbor are both semi-enclosed areas with low water circulation where multiple vessels are berthed. The dissolved copper concentrations observed in these locations may be associated with antifouling boat paints which contain copper. The California Department of Pesticide Regulation is currently evaluating alternatives to copper-containing bottom paints for boats[22].

The concentrations of organic chemicals were generally below detection level during this study. Detected concentrations for all but one chemical were always below relevant CTR Criteria for the Protection of Saltwater Aquatic Life for chronic exposure. Tributyltin (TBT) was detected in 7 of the 234 samples analyzed for TBT at concentrations that exceeded published National Ambient Water Quality Criteria chronic exposure limit; however, there is no California standard for this pollutant. TBT is a common chemical used in boat anti-fouling paints, and therefore the MS4 is not likely to be a source of TBT.

Of the various chlorinated pesticides (chlordane, dieldrin, and DDT and its metabolites), DDE was detected in only one of more than 100 samples analyzed using routine analytical techniques. PCBs were not detected in POLA waters relevant to the Peninsula EWMP during this study.

PAHs were not detected in any samples during the course of this study when using the standard analytical method. However, PAHs were detected in most samples when the use of a new ultra-low-detection-limit analytical method was employed.

[21] AMEC Earth & Environmental, Inc. 2009. Harbor Ambient Water Quality Summary in Support of the Port of Los Angeles and Port of Long Beach Water Resources Action Plan
[22] Ibid.

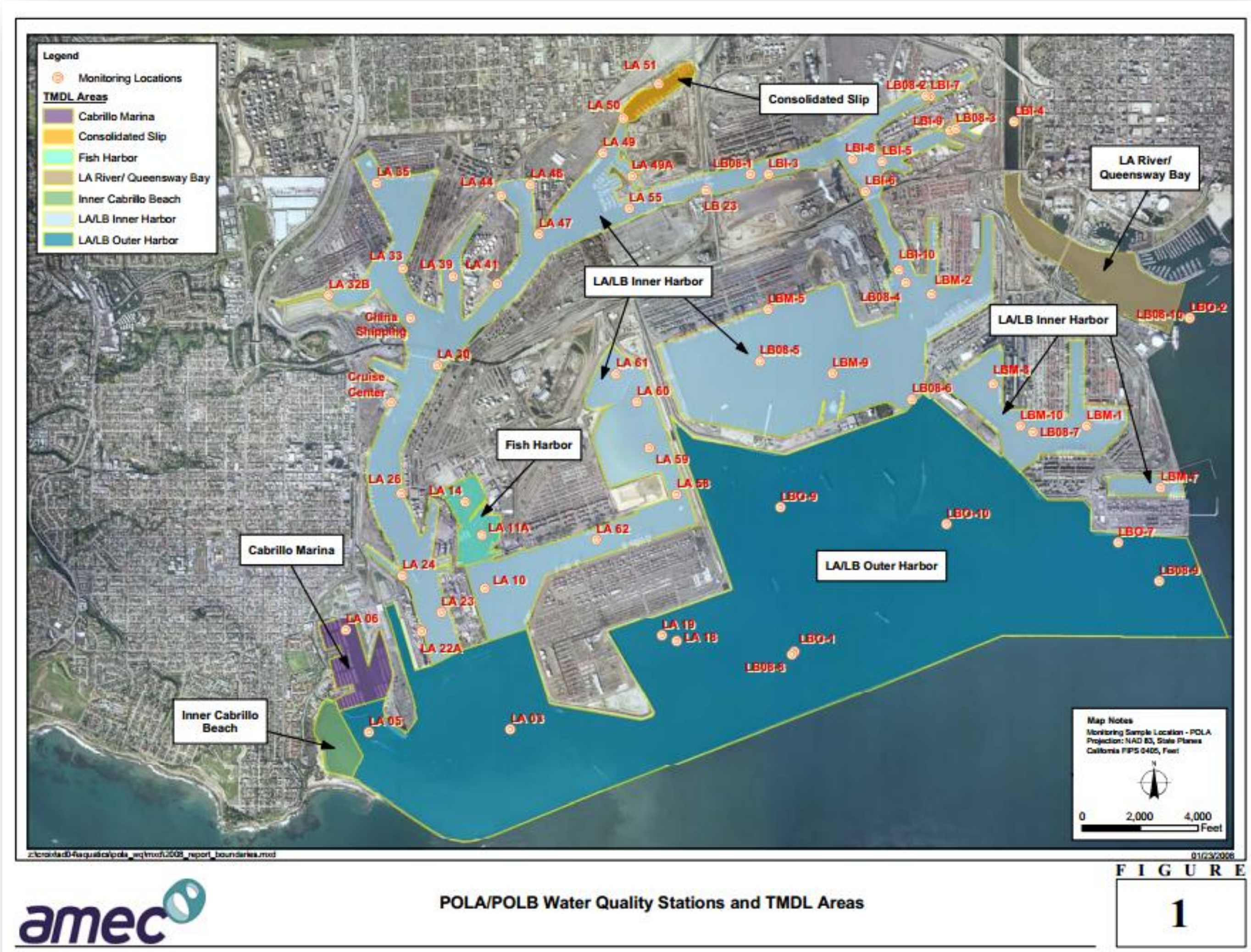

Figure 2-5 Ports of LA and LB Water Quality Monitoring Stations

b. Southern California Bight Sediment Toxicity (2008)

Every five years, the Southern California Bight Regional Monitoring Program led by the Southern California Coastal Water Research Project (SCCWRP), City of Los Angeles, Los Angeles County Sanitation Districts, and Orange County Sanitation District collects samples in offshore waters and coastal embayments (estuaries, marinas, ports, and other bay areas) between Point Conception, California, and the United States-Mexico border. Two hundred and twenty-two sites (220) were sampled between July 1 and September 30, 2008, of which six (6) were in Los Angeles Harbor waters relevant to the Peninsula WMG. Two types of toxicity tests were used in this study. A 10-day solid phase sediment toxicity test using the amphipod Eohaustorius estuarius was conducted on all samples. A second test, a sediment water interface (SWI) test using mussel embryos, was also conducted on all embayment samples, including those sites in the Los Angeles Harbor. The responses to these tests were classified into categories consistent with California Sediment Quality Objectives. Results were classified as "Nontoxic," "Low Toxicity," "Moderate Toxicity," or "High Toxicity". All of the stations in the Los Angeles Harbor waters relevant to the Peninsula EWMP were classified as either "Nontoxic" or "Low Toxicity" in this study[23].

2.1.4 Characterization of Stormwater and Non-Stormwater Discharge Quality

In order to begin to identify the sources of pollutants identified in the Waterbody Pollutant Categorization and prioritize implementation measures to address them, an analysis of stormwater and non-stormwater discharges from the MS4 was conducted.

2.1.4.1. Machado Lake Nutrient TMDL Monitoring

Two nutrient monitoring programs are currently taking place within the Peninsula EWMP area in compliance with the Machado Lake Nutrient TMDL. These monitoring programs, along with a summary of available data are included below.

a. Palos Verdes Peninsula Nutrient Coordinated Monitoring Program (Nutrient CMP)

Beginning in 2011, the cities of Palos Verdes Estates, Rancho Palos Verdes, Rolling Hills, and Rolling Hills Estates have conducted a Nutrient Coordinated Monitoring Program at four outfall locations that ultimately drain to Machado Lake. This monitoring program is conducted in compliance with the Machado Lake Nutrient TMDL. The monitoring locations are shown in Figure 1-1 as "nutrient" and were chosen because they are representative of the drainage from each of the Cities' land uses on the Peninsula tributary to Machado Lake. The Peninsula agencies chose to demonstrate compliance with the TMDL through concentration based water quality sampling. This sampling is conducted monthly and the results of all samples collected during the month (wet and dry) are averaged to obtain a monthly nitrogen average and a monthly phosphorus average. These average values are then compared against Waste Load Allocations set forth in the Machado Lake Nutrient TMDL.

Two seasons of monitoring have been completed thus far (2011-12 and 2012-13). Between August 2, 2011 and October 15, 2012 (2011-12 season) fifteen months of sampling was conducted. This included

[23] Bay, Steven M., Darrin J. Greenstein, Matthew Jacobe, Carlita Barton, Ken Sakamoto, Diana Young, Kerry Ritter, Kenneth C. Schiff. 2011. Southern California Bight 2008 Regional Monitoring Program: I. Sediment Toxicity. Southern California Coastal Water Research Project

twenty-two discrete stormwater sampling events, consisting of twenty dry weather sampling events and two wet weather sampling events[24].

From July 1, 2012 through June 30, 2013 (2012-2013 season), a total of twelve months of sampling was conducted. A total of fifteen discrete stormwater sampling events were collected, consisting of thirteen dry weather sampling events, and two wet weather sampling events.

Table 2-10 summarizes the data collected from 2011-2013 and demonstrates that drainage from the Peninsula meets 1st and 2nd interim TMDL compliance targets. As mentioned earlier, in-lake monitoring demonstrates that Machado Lake itself is not meeting the 1st interim targets during the summer months; however, the Peninsula WMG discharges have met the 2nd interim targets even during the critical summer dry weather period.

Table 2-10 Percentage of Nutrient CMP Average Monthly Total N and Total P Concentrations Exceeding TMDL WLAs for the Period August 2, 2011 through June 30, 2013

Constituent	% Monthly Averages Exceeding 1st Interim TMDL WLA (3/11/09)*	% Monthly Averages Exceeding 2nd Interim TMDL WLA (3/11/14)*	% Monthly Averages Exceeding Final TMDL WLA (9/11/18)***
Total Nitrogen	0%	0%	22%
Total Phosphorus	0%	0%	91%

*Samples are averaged over the course of a month to achieve a monthly average concentration, which is then compared to TMDL WLAs. Dry and wet weather samples are both included in the average calculation. The Machado Lake Nutrient TMDL 1st Interim WLAs for Total N and Total P are 3.5 and 1.25 mg/L respectively

**The Machado Lake Nutrient TMDL 2nd Interim WLAs for Total N and Total P are 2.45 and 1.25 mg/L respectively

** *The Machado Lake Nutrient TMDL Final WLAs for Total N and Total P are 1 and 0.1 mg/L respectively

b. County of Los Angeles Nutrient Monitoring Program

The Unincorporated County commenced a nutrient monitoring program in compliance with the Machado Lake Nutrient TMDL in June 2012. The Unincorporated County program consists of monitoring at three County Unincorporated land islands in the Machado Lake subwatershed. Two of the three islands lie within the Peninsula EWMP area. The Unincorporated County land area on the Peninsula that drains to Machado Lake constitutes 35% of the total County land in the Machado Lake Watershed. The pollutant loading from the Unincorporated County islands that lie within the Peninsula EWMP area will be assessed during the implementation of the CIMP.

2.2 Waterbody Pollutant Categorization

The analysis of existing water quality conditions within the Peninsula EWMP watersheds was used to classify pollutants into three categories each containing specific subcategories. These categories outline watershed priorities, which include, at a minimum, achieving applicable water quality-based effluent limitations and/or receiving water limitations established pursuant to Total Maximum Daily Loads (TMDLs).

The three categories and their subcategories are described below:

- Category 1 (Highest Priority): Water body-pollutant combinations for which water quality-based effluent limitations and/or receiving water limitations are established in Part VI.E TMDL Provisions and Attachments L through R of the MS4 Permit.

[24] Machado Lake Nutrient TMDL Annual Report 2012

  - Category 1A: Final deadlines within Permit term (after approval of EWMP & prior to December 28, 2017)
  - Category 1B: Interim deadlines within Permit term (after approval of EWMP & prior to December 28, 2017)
  - Category 1C: Final deadlines between December 29, 2017 - December 28, 2022
  - Category 1D: Interim deadlines between December 29, 2017 - December 28, 2022
  - Category 1E: Interim & final deadlines after December 28, 2022
  - Category 1F: Past final deadlines (final deadlines due prior to approval of EWMP)
  - Category 1G: USEPA established TMDLs with no implementation schedule
- Category 2 (High Priority): Pollutants for which data indicate water quality impairment in the receiving water according to the State Board's Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List (State Listing Policy) and for which MS4 discharges may be causing or contributing to the impairment.
  - Category 2A: Non-legacy pollutants
  - Category 2B: Bacterial indicators
  - Category 2C: Legacy pollutants
  - Category 2D: Water quality indicators
- Category 3 (Medium Priority): Pollutants for which there are insufficient data to indicate water quality impairment in the receiving water according to the State's Listing Policy, but which exceed applicable receiving water limitations for which MS4 discharges may be causing or contributing to the exceedance.
  - Category 3A: Non-legacy pollutants
  - Category 3B: Bacterial indicators
  - Category 3C: Legacy pollutants
  - Category 3D: Water quality indicators

Figure 2-6 presents Category 1 and 2 Pollutants identified through TMDLs and the State 303(d) List.

TMDL/303(d) Listed Pollutants
For Waterbodies within the Area Covered by the Peninsula EWMP group

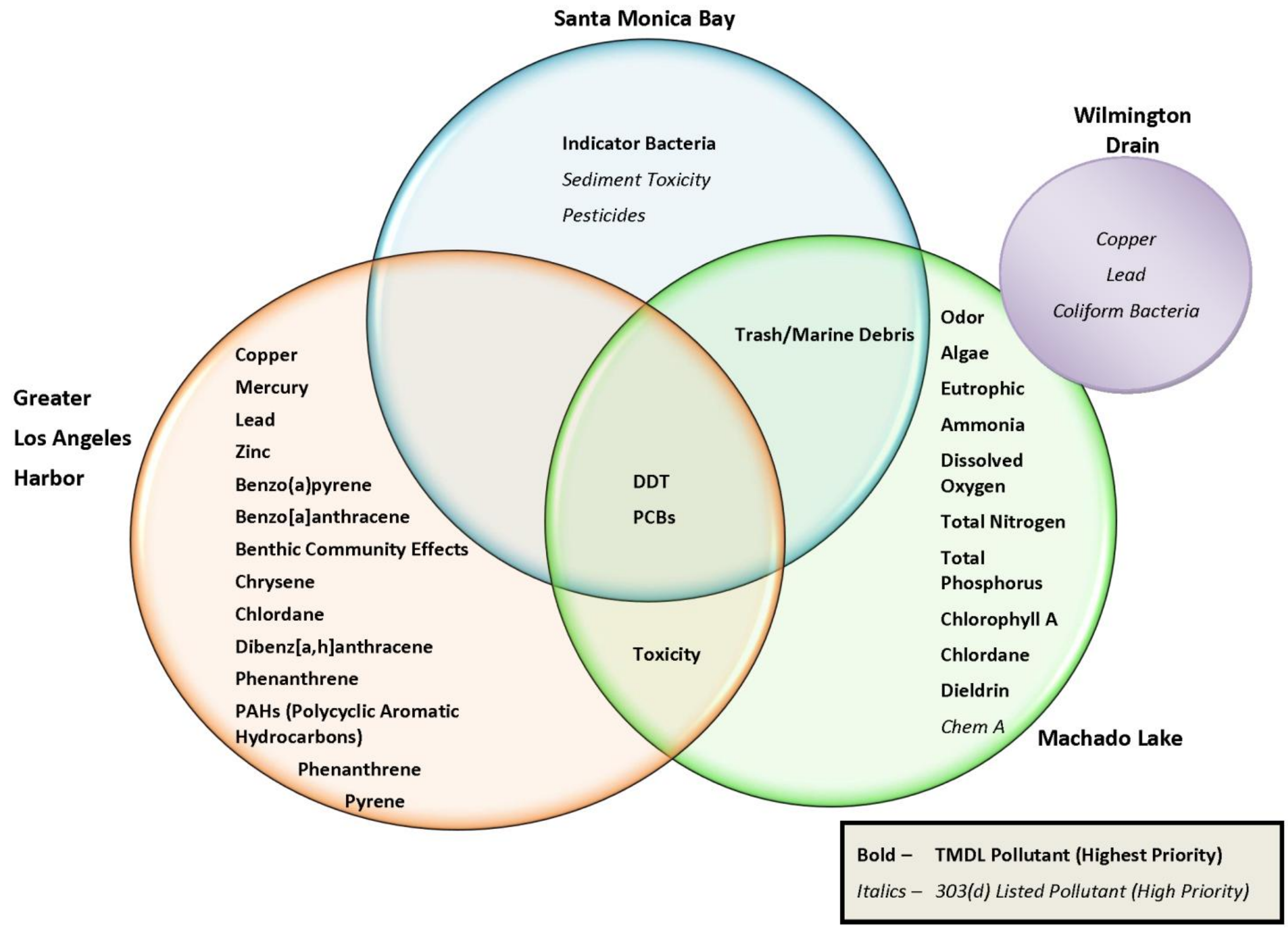

Figure 2-6 Pollutants for which Peninsula EWMP receiving waters are listed as impaired by the State's 303(d) List or have existing TMDLs in place

The waterbody-pollutant categories for the Peninsula EWMP Watersheds are summarized below. Unless otherwise indicated, all pollutants are associated with the water column.

Category 1A
Trash*– Machado Lake*

Category 1B
Marine Debris *(Trash and Plastic) – Santa Monica Bay*

Category 1C
PCBs (water, sediment, fish tissue) – *Machado Lake*
DDT (water, sediment, fish tissue) *– Machado Lake*
Chlordane (water, sediment, fish tissue) – *Machado Lake*
Dieldrin (water, sediment, fish tissue) – *Machado Lake*
Odor – *Machado Lake*
Eutrophic Conditions – *Machado Lake*
Algae – *Machado Lake*
Nitrogen – *Machado Lake*
Phosphorus – *Machado Lake*
Ammonia – *Machado Lake*
Chlorophyll a – *Machado Lake*
Dissolved Oxygen – *Machado Lake*

Category 1E
Copper (water and sediment) *– Inner Harbor, Outer Harbor, Cabrillo Marina, Fish Harbor*
Lead (water and sediment) *– Inner Harbor, Outer Harbor, Cabrillo Marina, Fish Harbor*
Mercury (water and sediment) *– Fish Harbor*
Zinc (water and sediment) *– Inner Harbor, Outer Harbor, Cabrillo Marina, Fish Harbor*
PAHs *– Inner Harbor, Outer Harbor, Cabrillo Marina, Fish Harbor*
Benzo(a)pyrene (water and sediment)
Chrysene (water and sediment)
Benzo[a]anthracene (water and sediment)
Dibenz[a,h]anthracene (water and sediment)
Phenanthrene (water and sediment)
Pyrene (water and sediment)
DDT (water, sediment, fish tissue) *– Inner Harbor, Fish Harbor, Cabrillo Marina, Outer Harbor*
PCBs (water, sediment, fish tissue) *– Inner Harbor, Fish Harbor, Cabrillo Marina, Outer Harbor*
Chlordane (water and sediment) *– Fish Harbor*

Category 1F
Bacteria (Coliform & Enterococcus) *– Santa Monica Bay*
Dry and Wet

Category 1G (USEPA Established)
DDT (water, sediment, fish tissue) *– Santa Monica Bay*
PCBs (water, sediment, fish tissue) *– Santa Monica Bay*

Category 2A*[25]

- ***Copper*** *– Wilmington Drain*
- ***Lead*** *– Wilmington Drain*

Category 2B

Coliform Bacteria *– Wilmington Drain*

The majority of data analyzed during the waterbody-pollutant categorization was collected pursuant to a TMDL; therefore, most of the priority pollutants fall into the Category 1: Highest Priority classification. No LA County mass emissions sampling stations exist within the Peninsula EMWP area. Category 1 pollutants will be considered with the Highest Priority within the Peninsula EWMP when determining control measures to be implemented in each watershed.

Category 2: High Priority pollutants were obtained from the State 303(d) List, and include five listings which are either being addressed by a TMDL or were listed in error[26]. **Section 2.1.2: Summary of Existing 303(d) Listings** describes the status of these listings. Category 2 pollutants will be considered with a High Priority within the Peninsula EWMP when determining control measures to be implemented.

There were no Category 3: Medium Priority pollutants identified during the Waterbody Pollutant Categorization; however, monitoring conducted under the CIMP will be used to identify any additional pollutants of concern within the Peninsula EWMP watersheds.

[25] The constituents listed in Category 2A have been targeted by the Regional Board for removal from the 303(d) list as soon as sufficient data is collected to support delisting. They are included as water quality priorities, and will be monitored for through the implementation of the CIMP.

[26] See Table 2-3 for explanations of 303(d) listed pollutants that were listed in error.

2.3 Source Assessment

A preliminary source assessment was conducted to identify potential sources within the watershed for the waterbody pollutant combinations classified as Category 1, 2, or 3 as outlined in MS4 Permit section VI.C.5.a.iii. Per the MS4 Permit, the following available data and documents were considered in the identification of known and suspected sources of the highest water quality priorities:

- Findings from the Peninsula WMG's Illicit Connections and Illicit Discharges Elimination Programs
- Findings from the Peninsula WMG's Industrial/Commercial Facilities Control Programs
- Findings from the Peninsula WMG's Development Construction Programs
- Findings from the Peninsula WMG's Public Agency Activities Programs
- TMDL Source Investigations
- Findings from Applicable Monitoring Programs
- TMDL Implementation Plans
- Other pertinent data, information, or studies related to pollutant sources and conditions that contribute to the highest water quality priorities
- Locations of the Peninsula Agencies' MS4s, including, at a minimum, all major outfalls and major structural controls for stormwater and non-stormwater that discharge to receiving waters
- Other known and suspected sources of pollutants in non-stormwater or stormwater discharges from the MS4 to receiving waters within the Peninsula EWMP area

The pollutants addressed in this section are toxics, metals, nutrients, bacteria, and trash. To generally describe the potential sources in the watershed, pollutant sources have been divided into the following categories: NPDES sources, road infrastructure, atmospheric deposition, and wastewater from sanitary sewer and SSOs. Typical sources of these pollutants are summarized in Table 2-11.

Table 2-11 Typical Sources of Pollutants[27]

Potential Source	Pollutants					Key References
	Bacteria	Nutrients	Metals	TSS/ Turbidity	Trash	
NPDES Sources						
Residential land areas	●	●		●	●	1, 2, 3, 4, 5, 6
Agricultural activities (i.e., animal operations, land applications)	●	●		●		7, 8, 9
Construction activities			●	●	●	7,9
Industrial/municipal activities	●		●			6, 10
POTW discharges			●			11
Landscaping, fertilizers		●				7, 9
Pet waste	●	●				9,
Wildlife	●					7, 1
Native geology		●	●			7, 1
Land surface erosion			●	●		7
Detergents		●				9
Car washing				●		7, 9
Road Infrastructure						
Transportation sources (i.e., copper brake pads, tire wear)			●			7, 9, 12, 13
Pavement erosion			●	●		7, 14
Atmospheric Deposition						
Construction activities			●			7, 9
Roofing			●			7
Resuspension of historic emissions in road dusts and soil particles			●			15
Land surface erosion		●				16
Sanitary Sewer and SSOs						
Sewer Leaks, sanitary sewer overflows (SSOs), illicit discharges, septic systems	●	●		●		7, 5,17
POTW discharges		●	●			12

1. LARWQCB (Los Angeles Regional Water Quality Control Board). 2002 & 2006. *Total Maximum Daily Load to Reduce Bacterial Indicator Densities at Santa Monica Bay Beaches During Wet Weather*. California Regional Water Quality Control Board, Los Angeles Region, Los Angeles, CA.
2. City of San Diego. 2009. *Aerial Deposition Study, Phase III*. Source Evaluation of TMDL Metals in the Chollas Creek Watershed. Final Report. San Diego, CA.
3. Gregorio, D., and S.L. Moore, 2004. *Discharge into state water quality protection areas in southern California*. http://www.sccwrp.org/Homepage/RecentPublications.aspx
4. San Diego County. 2011. 2009-2010 *Urban Runoff Monitoring Annual Report*. January 2011.
5. SDRWQCB (San Diego Regional Water Quality Control Board). 2010. *Revised TMDL for Indicator Bacteria, Project I - Twenty Beaches and Creeks in the San Diego Region.* Resolution No. R9-2010-0001.
6. Lattin, G.L., C.J. Moore, A.F. Zelkers, S.L. Moore, S.B. Weisberg. 2004. A Comparison of Neustonic Plastic and Zooplankton at Different Depths near the Southern California Shore. *Marine Pollution Bulletin*
7. County of Los Angeles. 2010. *Multi-pollutant TMDL Implementation Plan for the Unincorporated County Area of Los Angeles River Watershed*. County of Los Angeles, Los Angeles, CA

[27] City of San Diego and Caltrans 2012. *Tecolote Watershed Comprehensive Load Reduction Plan*. Final Report. San Diego, CA.

8. City of San Diego. 2011. *Mission Bay and La Jolla Watershed Urban Runoff Management Program*. Fiscal Year 2010 Annual Report.
9. USEPA (U.S. Environmental Protection Agency). 2011. *Sanitary sewer overflows and peak flows*.
10. Gregorio, D., and S.L. Moore, 2004. *Discharge into state water quality protection areas in southern California*. http://www.sccwrp.org/Homepage/RecentPublications.aspx
11. Sabin, L.D., K.C. Schiff, J. Hee Lim, and K.D. Stolzenback. 2004. *Atmospheric dry deposition of trace metals in the Los Angeles coastal region*. Southern California Coastal Research Project, Costa Mesa, CA.
12. Schueler, T., and H.K. Holland. 2000. *The Practice of Watershed Protection*. Center for Watershed Protection, Ellicott City, MD.
13. Stein, E.D., L.L. Tiefenthaler, and K. Schiff. 2006. Watershed-based Sources of Polycyclic Aromatic Hydrocarbons in Urban Storm Water. *Environmental Toxicology and Chemistry* 25(2):373–385
14. Caltrans (California Department of Transportation). 2003. *A Review of the Contaminants and Toxicity Associated with Particles in Stormwater runoff*. August 2003.
15. Sabin, L. and K. Schiff. 2007. *Metal Dry Deposition Rates along a Coastal Transect in Southern California*. Technical Report #509. Southern California Coastal Research Project, Costa Mesa, CA
16. Sutula, M., K. Kamer, and J. Cable. 2004. *Sediment as a nonpoint source of nutrients to Malibu Lagoon, California*. Southern California Coastal Research Project. Technical Report.
17. SWRCB (State Water Resources Control Board). 2011. NPDES Permits (including Storm Water). Excel spreadsheet download. Accessed December 6, 2011.

2.3.1. NPDES Sources

There are two categories of pollutants sources, point sources and non-point sources. Point source discharges are regulated through National Pollutant Discharge Elimination System (NPDES) permits. Point sources include stormwater and urban runoff through the MS4 and other NPDES discharges. Stormwater runoff in the watershed is regulated through several types of permits including MS4 permits, a statewide stormwater permit for Caltrans; a statewide Construction General Permit (CGP); and a statewide Industrial General Permit (IGP). The NPDES IGP regulates stormwater discharges and authorized non-stormwater discharges from ten specific categories of industrial facilities, including manufacturing facilities, oil and gas mining facilities, landfills, and transportation facilities. Furthermore, the NPDES CGP regulates stormwater discharges from construction sites that result in land disturbances equal to or greater than one acre. Point source discharges from IGP, CGP, residential, commercial and transportation activities can be a significant source of pollutant loads.

Non-point sources, by definition, include pollutants that reach waters from a number of land uses and are not regulated through NPDES permits. Non-point sources include existing contaminated sediments within the watershed and direct air deposition to the waterbody surface. These sources can enter the MS4 and contribute pollutants through it to receiving waterbodies.

The following provides additional discussion regarding the presence of pollutants in stormwater runoff within the watershed.

2.3.1.1. Toxics

The most significant toxic pollutants including legacy pollutants are PAH compounds, PCBs, DDT, chlordane and dieldrin.

Polycyclic aromatic hydrocarbons (PAHs) are a group of organic contaminants that form from the incomplete combustion of hydrocarbons. Most PAHs entering the environment are formed during the burning of (coal, oil, wood, gasoline, garbage, tobacco and other organic material). PAHs are an environmental concern because they are toxic to aquatic life and because several are suspected human carcinogens. Research has shown that the dominant source of origin is pyrogenic (combustion of organic matter) in the Los Angeles Region, and PAHs are often deposited through atmospheric deposition and delivered to waterbodies in stormwater runoff[7]. Other non-point sources may include leaking motor oil, tire wear and vehicular exhaust.

Polychlorinated biphenyls (PCBs) are mixtures of synthetic organic chemicals that were commonly used for various applications from approximately 1929 until 1979 when the U.S. banned PCB manufacturing,

processing, distribution, and use. PCBs are a ubiquitous environmental contaminant and, like DDT, they have persisted in the aquatic environment and continue to accumulate in fish tissue even though production of PCBs was banned 25 years ago. PCBs may also still exist in products made before 1977 such as transformers, old fluorescent lighting fixtures, household caulking, paints and waxes[28].

DDT, chlordane and dieldrin are organochlorine pesticides that were historically used in agricultural activities have resulted in contamination of the aquatic environment. In 1970, 1.2 million pounds of DDT were applied in California primarily to agricultural areas[29]. Although banned in the U.S. as an insecticide in 1972, DDT and its breakdown products have persisted accumulating at high concentrations, and adhering strongly to soil particles. Chlordane had both non-agricultural and agricultural applications in the U.S, including its use on corn, citrus, deciduous fruits, nuts and vegetables. Non-agricultural uses included treating of pests in residential lawns and gardens as well as structural pests such as termites. Dieldrin is also an organochlorine pesticide and was widely used from 1950-1970 as a structural pesticide for the control of termites as well as an agricultural pesticide for cotton, corn and citrus crops. Chlordane and dieldrin have similar properties to DDT and therefore, have a strong binding affinity to soil particles and are persistent compounds.

Legacy pesticides and insecticides have been banned from use for many years, yet they continue to persist in the environment and cause water quality impairments. Soils historically treated with DDT, chlordane and dieldrin continue to be a present source of pollutants in the environment. In addition, from 1947 to 1971 large quantities of DDT were discharged from the Montrose Chemical plant in Los Angeles, which manufactured DDT, to the Los Angeles County Joint Water Pollution Control Plant (JWPCP) and discharges into the Santa Monica Bay. PCBs also entered the JWPCP from several industrial sources in the Los Angeles area. Contamination of DDT and PCBs in the sediments of Santa Monica Bay, largely centered on the Palos Verdes shelf, have led to a large number of fish advisories for much of Santa Monica Bay and a commercial fishing ban in the area around the Palos Verdes shelf, which is an active USEPA Superfund site[30]. Possible delivery mechanisms of legacy pollutants may include fluxes from currently contaminated sediments into overlying waters and atmospheric deposition[31].

USEPA's Santa Monica Bay DDT and PCBs TMDL relies on a limited dataset to establish stormwater load allocations, relying on a single study (Curren et al., 2011) from a single creek (Ballona Creek, which is outside the Peninsula Cities WMG Area) to establish MS4 wasteload allocations throughout the entire SMB Watershed. It does not present sufficient data to assign MS4 contributions to the DDT and PCB concentrations observed in SMB, especially in light of the resident load of DDT and PCBs on the Palos Verdes Shelf associated with legacy discharges from Montrose via the Sanitation District's outfall.

[28] USEPA: Santa Monica Bay DDT and PCBs TMDL

[29] LARWQCB (Los Angeles Regional Water Quality Control Board). 2010. *Machado Lake Pesticides and PCBs TMDL*. California Regional Water Quality Control Board, Los Angeles Region, Los Angeles, CA.

[30] USEPA: Santa Monica Bay PCBs and DDT TMDL

[31] LARWQCB (Los Angeles Regional Water Quality Control Board & U.S. Environmental Protection Agency, Region 9). Dec. 2010. *Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxic Pollutants Total Maximum Daily Loads Draft.* California Regional Water Quality Control Board, Los Angeles Region, Los Angeles, CA.

2.3.1.1. Bacteria

Specific sources of bacteria are associated with anthropogenic and non-anthropogenic sources which may include:

- Environmental – soils, decaying vegetation,
- Animal wastes – birds, dogs, cats, horses, opossums, raccoons etc.
- Equestrian activities - horse waste such as manure, urine and soiled bedding are organic, biodegradable materials, and many of their physical, biological and chemical properties can be harmful to water quality. Many of the nutrients ingested by horses return to the environment in feces and urine which are then carried by runoff to streams and lakes. Some activities, such as heavy grazing or pasture use, remove the soil's vegetative cover and can expose the soil surface. Exposed soil is easily transported by runoff to the water bodies. Equestrian activities are a common practice within the watershed in public and private facilities. Horses are kept at public municipal stables, licensed privately owned operated stables and single-family residential properties. Organic debris from gardens, landscaping, parks, food waste and illegal dumping from recreational vehicle holding tanks among others, can be a source of elevated levels of total coliform bacteria.
- Sanitary sewer leaks and spills; illicit connections of sanitary lines to the storm drain system;
- Illegal connections and discharges are also very likely sources of bacteria in stormwater discharge.

Table 2-12 includes data based on Annual NPDES Reports submitted to the Regional Board from 2001-2012, for illicit connections and illicit discharges. There is currently no data available identifying the constituents associated with the IC/IDs recorded during this period.

Table 2-12 Number of Illicit Connections and Discharges From 2001-2012[32]

Permittee	Illicit Connections	Illicit Discharges
Rancho Palos Verdes	10	103
Palos Verdes	2	151
Rolling Hills Estates	5	78
Total	*17*	*332*

As mentioned previously, the Peninsula is currently in an anti-degradation condition for bacteria in Santa Monica Bay. Monitoring sites historically experience fewer exceedance days than the reference system used to determine allowable exceedance days in the Santa Monica Bay Beaches Bacteria TMDL. Therefore, the Peninsula beaches are currently in an antidegradation condition, which means it was determined that water quality is currently sufficient for protecting beneficial uses and requires that existing high quality be maintained.

2.3.1.2. Nutrients

Excessive input of nutrients (such as nitrogen and phosphorus) is the primary cause of eutrophication of surface waters, in which excess nutrients stimulate algal growth which leads to increased turbidity, decreased levels of oxygen, and odor problems. Possible sources of nutrients include runoff from residential and commercial areas due to landscaping activities and use of fertilizer for lawns and gardens, this includes organic debris. Activities such as washing cars, parking lots and driveways can

[32] Details on the Unincorporated County's illicit connections and discharges can be found in the Unincorporated County's Annual Report, which can be found online at http://dpw.lacounty.gov/wmd/NPDESRSA/AnnualReport/report_directory.cfm.

contribute nutrients to the watershed since most of the detergents used contain phosphorus. Other sources of nutrients include food wastes and domestic animal waste. These pollutants build up and are then washed into the waterways through the storm drain system when it rains. These kinds of loads are typically highest during the first major storm flush and even after extended periods of dry weather when pollutants have accumulated. Other major categories of nutrients sources include:

- Manure - Within the portion of the peninsula which drain to Machado Lake equestrian activities are very common within the watershed in private and public stables and even residential areas. Horse manure, if improperly managed, has the potential to pose a significant source of nutrients in runoff. Based on the Palos Verdes Peninsula Sub-watershed Coordinated Implementation Plan developed in compliance with the Machado Lake Nutrient TMDL (2011), it is estimated that in the Peninsula WMG's jurisdiction there are approximately 550 horses and 60 cattle within areas tributary to Machado Lake. Cattle and horses are similar in terms of nutrient generation, therefore the average 1,000-pound horse/cattle produces over 102 pounds of total nitrogen and 18.8 pounds of total phosphorous per year[33]. Based on this data, the amount of total nitrogen and phosphorous produced by these large animals is estimated to be 66,300 pounds per year of total nitrogen and 12,215 pounds per year of total phosphorous.
- Golf courses – golf courses are a major source of nutrients since fertilization activities and watering rates are generally much greater than in residential and commercial areas. The excess nutrients accumulated in the soils can be transported to waterways through excessive irrigation or stormwater runoff. There are approximately 7 golf courses within the Peninsula WMG.
- Air deposition of nitrogen due to air pollution, the predominate species being NHO_3 (nitric acid), NO_2 (nitrogen dioxide) and NH_3 (ammonia)[34].

2.3.1.3. Metals

Although naturally occurring, concentrations of heavy metals such as cadmium, copper, lead, and zinc are a concern in many watersheds because of potential industrial and urban discharges. These types of sources include Industrial General Permit (IGP) covered facilities, Construction General Permit (CGP) covered facilities, and other types of urban activities.

a. IGP Activities

Less than 2% of the Peninsula WMG land use acreage is designated for industrial use. According to the Stormwater Multiple Application and Report Tracking System (SMARTS) database, there is approximately one current active industrial permit and zero violations recorded for inspections conducted from 2002-2012.

Table 2-13 Active IGP Facilities According to SMARTS[a]

Permittee	Total
Rancho Palos Verdes	0
Palos Verdes	0
Rolling Hills Estates	3
Unincorporated County	0

[a]As of May 1, 2014

[33] Wheeler and Zajaczkowski. *Horse Stable Manure Management, Publication G-97*. Penn State College of Agricultural Sciences Cooperative Extension, Agricultural and Biological Engineering
[34] Palos Verdes Peninsula Subwatershed Coordinated Implementation Plan. 2011.

b. CGP Activities

Discharges covered under the CGP also have the potential to contribute metals loading from construction sites. Sediment delivered from construction sites can contain metals from construction materials and heavy equipment. Additionally, metals can leach out of building materials and construction waste exposed to stormwater[35].

According to the Stormwater Multiple Application and Report Tracking System (SMARTS) database, there are approximately six current active construction permits and zero violations recorded for inspections conducted from 2002-2012.

Table 2-14 Active CGP Sites According to SMARTS[a]

Permittee	Total
Rancho Palos Verdes	5
Palos Verdes	0
Rolling Hills Estates	3
County Unincorporated	0

[a]As of May 1, 2014

2.3.2. Other Urban Activities

General wear and tear of automotive parts can be a significant source of metals. For example, brake wear can release copper, lead, and zinc into the environment and contribute concentrations of metals to roads and in turn urban runoff. Motor oil and automotive coolants spills are another potential source of metals. Pesticides, algaecides, wood preservatives, galvanized metals, and paints used across the watershed can also contain these metals.

The fertilizers used for lawn and landscape maintenance are also a source of metals and organic chemicals. Fertilizers, herbicides, and pesticides contain metals such as cadmium, copper, mercury, zinc, lead, iron, and manganese, which are also distributed when applying fertilizers and pesticides[36].

2.3.3. Trash

The major source of trash in the Peninsula WMG results from litter, which is intentionally or accidentally discarded in watershed drainage areas. Transport mechanisms include storm drain, wind action and direct disposal into waterbodies. Several studies have shown that commercial operations generate more pollutants than residential operations, and as much as three times the amount generated from light industrial operations[37].

2.3.4. Road Infrastructure Sources

Runoff from highways and roads carries a significant load of pollutants. Pollutants originate from cars, roadway degradation, and landscaping surrounding the highways. Typical contaminants associated with these include sediment, heavy metals, oils and grease, debris, fertilizers, and pesticides, among others[38]. The use and wear of cars is one of the most prevalent sources of roadway pollutants. A study

[35] Raskin, L., M.J. Singer, and A. DePaoli. 2004. Final Report to the State Water Resources Control Board Agreement number 01-269-250. University of California, Davis, CA.

[36] County of Los Angeles. 2010. *Multi-pollutant TMDL Implementation Plan for the Unincorporated County Area of Los Angeles River Watershed*. County of Los Angeles, Los Angeles, CA

[37] LARWQCB. 2007. *Trash Total Maximum Daily Loads for the Los Angeles River Watershed.* Los Angeles, CA.

[38] Caltrans (California Department of Transportation). 2003. *Discharge characterization study report*. California Department of Transportation, Sacramento, CA.

found that cars are the leading source of metal loads in stormwater, producing over 50 percent of copper, cadmium, and zinc loads[39]. Vehicle brake pads constitute the single largest source of copper[40]. Simultaneously, tires, and engine parts are also a significant source of metals pollutants; almost 50 percent of tire wear accounts for over 50 percent of the total cadmium and zinc loads[41]. Roadways can also be a source of nutrients because nutrients are found in fertilizers that are commonly applied to parkway landscaping.

Table 2-15 Typical Road Infrastructure Sources of Pollutants[42]

Source	Cadmium	Chromium	Copper	Iron	Nickel	Lead	Zinc	PAHs	Nutrients	Synthetic Organic Chemicals
Gasoline	●		●			●	●			
Exhaust					●	●		●		●
Motor oil and grease				●	●	●	●	●		
Antifreeze	●	●	●	●		●	●	●		
Undercoating						●	●			
Brake Linings			●	●	●	●	●			
Tires	●		●			●	●	●		
Asphalt	●		●		●		●	●		
Concrete			●		●		●			
Diesel Oil	●	●				●	●			●
Engine wear				●	●	●	●			
Fertilizers, pesticides, and herbicides	●		●	●	●		●		●	●

2.3.5. *Atmospheric Deposition*

Atmospheric deposition is the direct and indirect transfer of pollutants from the air to surface waters. Pollutants in the atmosphere deposit onto solid surfaces and then are washed off by rain, becoming part of the stormwater runoff that reaches the watershed. Atmospheric deposition of pollutants either directly to a waterbody surface or indirectly to land in the watershed can be a large source of contamination. Typical pollutants associated with atmospheric deposition are metals, PAHs, PCBs, and, to a lesser extent, nutrients. These pollutants enter the atmosphere from point sources (i.e., industrial facility emitting metals into the air). A comparison of trace metals contributions from aerial deposition, sewage treatment plans, industrial activities, and power plants is shown in Table 2-16.

[39] Schueler, T., and H.K. Holland. 2000. *The Practice of Watershed Protection*. Center for Watershed Protection, Ellicott City.
[40] TDC Environmental 2004, *Copper Sources in Urban and Shoreline Activities*. San Francisco, CA.
[41] Davis A.P., M. Shokouhian, and S. Ni. 2001. Loading estimates of lead, copper, cadmium, and zinc in urban runoff from specific sources. *Chemosphere.*
[42] Nixon, H., and J.D. Saphores. 2007. Impacts of motor vehicle operation on water quality: Clean-up costs and policies. Transportation Research Part D. *Transport and Environment.*

Table 2-16 Comparison of source annual loadings to Santa Monica Bay (metric tons/year)[43]

Metal	Aerial Deposition	Non-Aerial Sources		
		Sewage Treatment Plants	Industrial	Power Plants
Chromium	0.5	0.6	0.02	0.14
Copper	2.8	16	0.03	0.01
Lead	2.3	<0.01	0.02	<0.01
Nickel	0.45	5.1	0.13	0.01
Zinc	12.1	21	0.16	2.4

Nutrients are also atmospherically deposited. According to a research study conducted in 2004, the annual loading of nitrogen through atmospheric deposition in the nearby Los Angeles River watershed is 5,559 tons per year[44].

2.3.6. Sanitary Sewer and Sanitary Sewer Overflows (SSOs)

Sanitary sewer systems and septic systems are potential sources of contaminants. Aging systems in need of repair or replacement, severe weather, improper system operation and maintenance (O&M), clogs, and root growth can contribute to sanitary sewer leaks and overflows. When sanitary sewers overflow or leak, they can release raw sewage into the environment, which can contain pollutants such as suspended solids, pathogenic organisms, toxic pollutants, oil and grease; but in particular, high concentrations of bacteria and nutrients[19].

According to the SSO database in the California Integrated Water Quality System (CIWQS) a total of 226 SSOs have been recorded within the Peninsula WMG since 2006. Table 2-17 includes information of the reported SSO discharges.

Table 2-17 Reported SSO discharges (Category 1-3) from 2006 to 2012 located within the Peninsula WMG

Permittee	Total SSOs	Total Volume (gal)
Rancho Palos Verdes	71	28,105
Palos Verdes Estates	60	31,350
Rolling Hills Estates	13	3,395
Total	*144*	*62,850*

2.3.7. Outfalls

Stormwater outfalls are point sources of stormwater runoff into receiving waterbodies and are regulated by the NPDES MS4 permit. The locations of all MS4 major outfalls that contribute significant discharges to receiving waters are being investigated through the CIMP, and will be evaluated further during development of the EWMP. Source investigations of significant discharges will be conducted per MS4 Permit requirements.

[43] Stolzenbach, K.D. 2006. Atmospheric Deposition Grades B+ to C-. Southern California Environmental Report Card 2006. University of California, Los Angeles, Institute of the Environment, Los Angeles, CA.
[44] Lu, R., K. Schiff, S. Solzenbach, and D. Keith. 2004. *Nitrogen Deposition on Coastal Watersheds in the Los Angeles Region*. Southern California Coastal Water Research Project Annual Report. 2003-2004. pp. 73– 81.

2.4 Prioritization

MS4 Permit section VI.C.5.a.iv outlines factors that should be considered when developing the sequence of addressing Category 1, 2, and 3 pollutants within the Peninsula EWMP watersheds. Based on **Section 2.3: Source Assessment** and the Reasonable Assurance Analysis (RAA), a sequence for addressing these pollutants will be developed based on the following priorities:

- Highest: TMDLs
  - TMDL pollutants with past due interim or final limits
  - TMDL pollutants with interim and final limits that fall within the MS4 Permit term, or the time period: September 6, 2012 – October 25, 2017
  - Pollutants that are in the same class as a TMDL pollutant
- Second Highest: Other Receiving Water Considerations
  - Pollutants on the 303(d) List for which MS4 discharges are a suspected source based on findings from the source assessment
  - Pollutants that exceed receiving water limitations and the findings from the source assessment indicate the MS4 as a source (these pollutants will be determined based on monitoring data collected as part of the CIMP).

Table 2-18 summarizes the priority pollutants for the Peninsula EWMP based on their association with MS4 discharges (based on the Source Assessment) and the prioritization criteria described above:

Table 2-18 Peninsula EWMP Priority Pollutants

Category	Class	Pollutant	Waterbody	Potentially Associated with MS4	Priority**
Category 1	Trash	Trash/Marine Debris	Santa Monica Bay and Machado Lake	Yes	Highest
	Bacteria	Coliform and Enterococcus	Santa Monica Bay and Machado Lake (Wilmington Drain)	Yes	Highest
	Historic Organics	PCBs	Santa Monica Bay, Machado Lake and Los Angeles Harbor	Yes	Second Highest
		DDT	Santa Monica Bay, Machado Lake and Los Angeles Harbor	Yes	Second Highest
		Chlordane	Machado Lake and Los Angeles Harbor	Yes	Second Highest
		Dieldrin	Machado Lake	Yes	Second Highest
	Nutrients	Nitrogen	Machado Lake	Yes	Second Highest
		Phosphorus	Machado Lake	Yes	Second Highest
		Ammonia	Machado Lake	Yes	Second Highest
		Chlorophyll a*	Machado Lake	Yes	Second Highest
		Dissolved Oxygen*	Machado Lake	Yes	Second Highest
		Odor*	Machado Lake	Yes	Second Highest
		Eutrophic Conditions*	Machado Lake	Yes	Second Highest
		Algae*	Machado Lake	Yes	Second Highest
	Metals	Copper	Los Angeles Harbor	Yes	Second Highest
		Lead	Los Angeles Harbor	Yes	Second Highest
		Mercury	Los Angeles Harbor	Yes	Second Highest
		Zinc	Los Angeles Harbor	Yes	Second Highest
	PAHs	PAHs	Los Angeles Harbor	Yes	Second Highest
		Benzo(a)pyrene	Los Angeles Harbor	Yes	Second Highest
		Chrysene	Los Angeles Harbor	Yes	Second Highest
		Benzo[a]anthracene	Los Angeles Harbor	Yes	Second Highest
		Dibenz[a,h]anthracene	Los Angeles Harbor	Yes	Second Highest
		Phenanthrene	Los Angeles Harbor	Yes	Second Highest
		Pyrene	Los Angeles Harbor	Yes	Second Highest
Category 2	Metals	Copper	Machado Lake (Wilmington Drain)	Yes	Second Highest
		Lead	Machado Lake (Wilmington Drain)	Yes	Second Highest
	Bacteria	Coliform Bacteria	Machado Lake (Wilmington Drain)	Yes	Highest

* These "constituents" are not pollutants, but rather describe water quality conditions associated with excessive nutrients; therefore they have been categorized in the same class as other nutrients.

** Highest:-TMDL pollutants with past deadlines or interim/final deadlines that fall within the MS4 Permit term and those constituents in the same class
Second Highest: Pollutants for which data indicate impairment or exceedances of receiving water limitations and the findings from the source assessment implicates discharges from the MS4

2.4.1. Scheduling

A sequence for addressing the highest and second highest priority pollutants summarized in Table 2-18 will be developed during EWMP development. The MS4 Permit outlines the following factors to consider in the scheduling of control measures to address these Water Quality Priorities:

- TMDL Implementation Schedules
- Pollutant Class: Non-TMDL pollutants in the same class as TMDL pollutants will be addressed according to applicable TMDL schedule
- No Implementation Schedule: Pollutants for which no implementation schedule exists will develop a schedule with appropriate milestones
- Water Quality Exceedances: Pollutants that are found through the CIMP to exceed water quality limitations will be evaluated to determine their association with the MS4. If it is determined that the MS4 caused or contributed to the exceedance, a compliance schedule with appropriate milestones will be developed as part of the adaptive management process

3. Watershed Control Measures

The selection of Watershed Control Measures (WCMs) to address water quality priorities within Peninsula WMG is a vital component of the EWMP planning process. The Peninsula WMG has already proposed and implemented a number of WCMs in the Peninsula EWMP watersheds that collectively may contribute to considerable load reductions of pollutants of concern. These existing and planned Best Management Practices (BMPs) provide a head start in the planning of WCMs to address water quality priorities within the Peninsula EWMP. The existing and planned BMPs described in this section, along with opportunities identified during EWMP development, will be modeled using a Reasonable Assurance Analysis (RAA) in order to quantify their associated benefits and impacts. The RAA will assist the Peninsula WMG in determining an optimized combination of efforts to meet water quality goals.

3. 1 Watershed Control Measure Categories

There are many different types of WCMs that provide varying benefits from their implementation. The following section outlines different types of WCMs available to the Peninsula WMG.

3.1.1 Minimum Control Measures (MCMs)

MS4 Permit Part VI.D outlines six categories of minimum control measures (MCMs), which must be incorporated into the Peninsula EWMP. In addition, a Progressive Enforcement Policy to enforce the provisions of the MCMs must be in place.

The six categories of MCMs that are outlined in the MS4 Permit Part VI.D are as follows:

- Development Construction Program
- Planning and Land Development Program
- Industrial Commercial Facilities Control Program
- Illicit Connections and Illicit Discharges Detection and Elimination Program
- Public Agency Activities Program
- Public Information and Participation Program

Section 3.3: Existing and Potential Control Measures summarizes existing control measures, including MCMs in place in the Peninsula EWMP area and outlines additional control measures that will be considered during the development of the Peninsula EWMP. **Section 3.5: MCM Customization** outlines a process for identifying and evaluating MCMs customization opportunities. This process will be used during the development of the Peninsula EWMP to focus resources on the high priority issues by identifying potential modifications to MCMs that will more efficiently address watershed priorities.

3.1.2 Non-Structural Control Measures

Nonstructural BMPs are management programs or activities, also known as Institutional Controls, designed to reduce or eliminate pollutant loading by addressing its source[45]. **Section 3.3: Existing and Potential Control Measures** summarizes existing Institutional Controls in place in the Peninsula EWMP area, and outlines additional potential Institutional Controls that will be considered during the development of the Peninsula EWMP.

[45] City of San Diego: San Diego River Comprehensive Load Reduction Plan

3.1.3 Structural Control Measures

Structural BMPs are an important component of the Peninsula EWMP's load reduction strategy. Structural BMPs are constructed to capture runoff and filter, infiltrate, or treat it. If properly maintained, these BMPs can have high pollutant load removal efficiencies (see **Section 3.2: Performance Evaluation of Structural BMPs**); however, they tend to be more expensive than non-structural BMPs. The two prevailing approaches for implementing structural BMPs are Regional and Distributed approaches. Both serve important purposes and should be considered in combination to determine the best possible implementation strategy to address Peninsula EWMP water quality priorities. **Section 3.3: Existing and Potential Control Measures** summarizes existing and planned structural controls in place in the Peninsula EWMP area, and **Section 3.4: Approach for Identifying and Evaluating Regional EWMP Projects** describes the process for identifying and evaluating Regional EWMP projects.

3.1.3.1 Distributed

Distributed structural BMPs are built within the landscape usually at the site-scale[46]. They are intended to treat stormwater runoff at the source, and usually capture runoff from a single parcel or site.

3.1.3.2 Regional

Regional BMPs are large Structural BMPs that receive flows from neighborhoods or large areas and may serve dual purposes for flood control or groundwater recharge[47]. The term "Regional BMP" should be distinguished from "Regional EWMP BMP" as defined by the MS4 Permit (referred to herein as EWMP BMP). The MS4 Permit defines EWMP BMPs as "multi-benefit regional projects that, wherever feasible, retain (i) all non-stormwater runoff and (ii) all stormwater runoff from the 85th percentile, 24-hour storm event for the drainage areas tributary to the projects, while also achieving other benefits including flood control and water supply, among others"[48]. Regional BMPs may not necessarily meet the MS4 Permit definition for a regional EWMP project; however, may still be included in the Peninsula EWMP as control measures implemented to meet water quality goals.

3.1.3.3 Structural BMP Sub-Categories

Structural BMPs fall under a variety of subcategories that correspond to their function and water quality benefit. Some of the most common of these subcategories are described below. These subcategories will be used throughout the Work Plan to describe existing, planned, and potential regional and distributed BMPs.

a. Infiltration BMPs

Infiltration BMPs allow for stormwater to percolate through the native soils and recharge the underlying groundwater table, subsequently decreasing the volume of water discharged to the downstream waterbodies. These BMPs must be constructed in areas where the native soils have percolation rates and groundwater levels sufficient for infiltration.

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[46] Distributed BMPs can include multi-parcels/block-scale systems for smaller parcels
[47] City of San Diego: San Diego River Comprehensive Load Reduction Plan
[48] Order No. R4-2012-0175 NPDES Permit No. CAS004001 Waste Discharge Requirements for Municipal Separate Storm Sewer System (MS4) Discharges within the Coastal Watersheds of Los Angeles County, except those Discharges Originating from the City of Long Beach MS4Section VI.C.1.g

Infiltration Basin

An infiltration basin consists of an earthen basin with a flat bottom. An infiltration basin retains stormwater runoff in the basin and allows the retained runoff to percolate into the underlying soils. The bottom of an infiltration basin is typically vegetated with dryland grasses or irrigated turf grass.

Infiltration Trench

An infiltration trench is a long, narrow, rock-filled trench with no outlet other than for overflow. Runoff is stored in the void space between stones and infiltrates through the bottom and sides of the trench. Infiltration trenches provide the majority of their pollutant removal benefits through volume reduction. Pretreatment is important for limiting amounts of coarse sediment entering the trench which can clog and render the trench ineffective.

Bioretention with no Underdrain

Bioretention facilities with no underdrain are landscaped shallow depressions that capture and infiltrate stormwater runoff. These facilities function as a soil and plant-based filtration device that removes pollutants through a variety of physical, biological, and chemical treatment processes. The facilities normally consist of a ponding area, mulch layer, engineered media, and vegetation. As stormwater passes down through the media, pollutants are filtered, adsorbed, and biodegraded by the soil and vegetation.

Drywell

Drywells are similar to infiltration trenches in their design and function; however, drywells generally have a greater depth to footprint area ratio and can be installed at relatively deep depths. A drywell is a subsurface storage facility designed to temporarily store and infiltrate runoff. A drywell may be either a small excavated pit filled with aggregate or a prefabricated storage chamber or pipe segment.

Permeable Pavement

Permeable Pavement (concrete, asphalt, and pavers) contain small voids that allow water to pass through to a gravel base. They come in a variety of forms; they may be a modular paving system (concrete pavers, grass-pave, or gravel-pave) or poured in place pavement (porous concrete, permeable asphalt). Permeable pavements treat stormwater and remove sediments and metals within the pavement pore space and gravel base. While conventional pavement results in increased rates and volumes of surface runoff, properly constructed and maintained permeable pavements allow stormwater to percolate through the pavement and enter the soil below. This facilitates groundwater recharge while providing the structural and functional features needed for the roadway, parking lot, or sidewalk. The paving surface, subgrade, and installation requirements of permeable pavements are more complex than those for conventional asphalt or concrete surfaces.

b. Biotreatment BMPs

Biotreatment BMPs treat stormwater through a variety of physical, chemical, and biological processes prior to being discharged to the MS4 system. These BMPs should be considered where Infiltration BMPs are infeasible.

Bioretention with Underdrains

Bioretention stormwater treatment facilities are landscaped shallow depressions that capture and filter stormwater runoff. These facilities function as a soil and plant-based filtration device that removes pollutants through a variety of physical, biological, and chemical treatment processes. The facilities normally consist of a ponding area, mulch layer, engineered media, and vegetation. As stormwater passes down through the media, pollutants are filtered, adsorbed, biodegraded, and sequestered by the soil and vegetation. Bioretention with underdrain systems are utilized for areas containing native soils with low permeability or steep slopes, where the underdrain system routes the treated runoff to the storm drain system.

Vegetated Swale

Vegetated swales are open, shallow channels with low-lying vegetation covering the side slopes and bottom that collect and slowly convey runoff flow to downstream discharge points. Vegetated swales provide pollutant removal through settling and filtration in the vegetation (usually grasses) lining the channels. In addition, although it is not their primary purpose, vegetated swales also provide the opportunity for volume reduction through subsequent infiltration and evapotranspiration and reduce the flow velocity. Where soil conditions allow, volume reduction in vegetated swales can be enhanced by adding a gravel drainage layer underneath the swale allowing additional flows to be retained and infiltrated. Where slopes are shallow and soil conditions limit or prohibit infiltration, an underdrain system or low flow channel for dry weather flows may be required to minimize ponding and convey treated and/or dry weather flows to an acceptable discharge point. An effective vegetated swale achieves uniform sheet flow through a densely vegetated area for a period of several minutes (depending on design standard used).

Wet Detention Basin

Wet detention basins are constructed, naturalistic ponds with a permanent or seasonal pool of water (also called a “wet pool” or “dead storage”). Aquascape facilities, such as artificial lakes, are a special form of wet pool facility that can incorporate innovative design elements to allow them to function as a stormwater treatment facility in addition to an aesthetic water feature. Wet ponds require base flows to exceed or match losses through evaporation and/or infiltration, and they must be designed with the outlet positioned and/or operated in such a way as to maintain a permanent pool. Wet ponds can be designed to provide extended detention of incoming flows using the volume above the permanent pool surface.

Dry Extended Detention Basin

Dry extended detention basins are basins whose outlets have been designed to detain the stormwater runoff to allow particulates and associated pollutants to settle out. Dry extended detention basins do not have a permanent pool; they are designed to drain completely between storm events. They can also be used to provide hydromodification and/or flood control by modifying the outlet control structure and providing additional detention storage. The slopes, bottom, and forebay of Dry extended detention basins are typically vegetated.

c. *Pre-Treatment BMPs*

Pre-treatment BMPs are typically not used as primary treatment; however, they are highly recommended for preliminary treatment in order to prolong the life and prevent clogging of the downstream system in a treatment train.

Media Filters

Media filters are usually designed as multi-chambered stormwater practices; typically with the first as a settling chamber and the second is a filter bed filled with sand or another filtering media. As stormwater flows into the first chamber, large particles settle out, and then finer particles and other pollutants are removed as stormwater flows through the filtering medium. They can also be used as pre-treatment, with their location prior to any infiltration or biotreatment BMP.

Catch Basin Inserts

Catch basins inserts typically include a grate or curb inlet and a sump to capture sediment, debris, and pollutants. Filter fabric can also be included to provide additional filtering of particles. The effectiveness of catch basins, their ability to remove sediments and other pollutants, depends on its design and maintenance. Some inserts are designed to drop directly into existing catch basins, while others may require retrofit construction. Similar to media filters, catch basin filters can also be used as a pre-treatment BMP for infiltration and biotreatment BMPs.

d. *Rainfall Harvest*

Rainfall Harvest BMPs capture rainwater to be reused in lieu of discharging directly to the MS4.

Above Ground Cisterns

Cisterns are large above ground tanks that store stormwater collected from impervious surfaces for domestic consumption. Above ground cisterns are used to capture runoff. Mesh screens are typically used to filter large debris before the stormwater enters the cistern. The collected stormwater could potentially be used for landscape irrigation and some interior uses, such as toilets and washing machines. The collection and consumption of the stormwater results in pollution control, volume reduction, and peak flow reduction from the site.

Underground Detention

Underground detention systems function similarly to above ground cisterns in that they collect and use stormwater from impervious surfaces. These systems are concealed underground and can allow for larger stormwater storage, capture additional impervious surfaces not easily captured in an above ground system (e.g. parking lots and sidewalks).

e. Diversion Systems

Low Flow Diversion

Flow diversion systems collect and divert runoff. Flow diversion structures can primarily be used in two ways. First, flow diversion structures may be used to direct dry weather flows to a treatment facility, preventing the runoff from reaching a receiving waterbody. This is typically done with low flow runoff, which occurs during periods of dry weather. Second, flow diversion structures can also be modified by incorporating them into other pollution control BMPs. For example, diverted flow can be fed into an infiltration system or an infiltration basin. Properly designed stormwater diversion systems are very effective for preventing stormwater from being contaminated and for routing contaminated flows to a proper treatment facility.

3. 2 Performance Evaluation of Structural Control Measures

The performance of existing and planned BMPs in the Peninsula EWMP area will be evaluated through the RAA as described in section VI.C.5.b.iv(5) of the MS4 Permit, both in terms of volume capture (based on BMP design criteria) and predicted effluent quality. An analysis of BMP Performance data has been summarized in Appendix 3.A. Please refer to **Section 4: Reasonable Assurance Analysis Approach** for more detail on the modeling approach.

3. 3 Existing and Potential Control Measures

This section describes the BMP suite available to the Peninsula WMG to address water quality priorities. It summarizes existing and planned BMPs in place in Peninsula EWMP watersheds, and describes potential additional controls that will be considered during EMWP development. Existing control measures that were implemented after applicable TMDL effective dates or are planned for implementation in the future will be considered for inclusion in the RAA to achieve target load reductions (see **Section 4: RAA Approach** for more detail on the RAA).

Existing MCMs being implemented by the Peninsula WMG agencies, along with additional MCM elements that will be implemented, are summarized below in **Section 3.3.1: MCMs**. The approach to customization of MCMs is discussed in **Section 3.5**. Existing and Potential Non Structural BMPs to be considered during Peninsula EWMP development are summarized in **Sections 3.3.2 and 3.3.3**, and **Section 3.3.4** outlines Existing and Planned Structural BMPs.

3.3.1 MCMs

3.3.1.1. Development Construction Program

Polluted stormwater runoff from construction sites often flows to the MS4 and ultimately is discharged into local rivers and streams. Sediment is usually the main pollutant of concern from construction sites. According to the 2000 National Water Quality Inventory, States and Tribes report that sedimentation is one of the most widespread pollutants affecting assessed rivers and streams[49]. The Peninsula WMG agencies implement and enforce a Development Construction Program to reduce pollutants in stormwater runoff resulting from construction activities that result in a land disturbance of greater than or equal to one acre.

[49] United States Environmental Protection Agency. 2005. Stormwater Phase II Final Rule: Construction Site Runoff Control Minimum Control Measure

3.3.1.2. Planning and Land Development Program

The Peninsula WMG agencies implement and enforce a Planning and Land Development Program to minimize the impacts of new development and redevelopment projects on water quality and hydrology. This program includes the installation of Low Impact Development (LID) BMPs and source control BMPs designed and sized for efficient pollutant removal. Additionally, the cities within the Palos Verdes Peninsula currently limit the amount of impervious surfaces to 10% - 65% of the total developed property for residential properties, which range in size from ¼ acre to greater than one acre in lot size[50]. Additionally, the Unincorporated County has been implementing an LID ordinance for several years which goes above and beyond the requirements set forth in the 2001 MS4 Permit for new development and redevelopment projects.

3.3.1.3. Industrial Commercial Facilities Control Program

The Peninsula WMG agencies implement and enforce an Industrial Commercial Facilities Control Program to ensure implementation of BMPs and to eliminate illicit connections/discharges from industrial and commercial facilities to control the discharge of pollutants to the MS4 from these sites.

3.3.1.4. Illicit Connections and Illicit Discharges Detection and Elimination Program

Discharges from MS4s often include natural baseline flows as well as wastes and wastewater from non-stormwater sources. A study conducted in 1987 in Sacramento, California, found that almost one-half of the water discharged from a local MS4 was not directly attributable to precipitation runoff. A significant portion of these dry weather flows were from illicit and/or inappropriate discharges and connections to the MS4[51]. The Peninsula WMG agencies implement and enforce an Illicit Connections and Illicit Discharges Detection and Elimination Program to detect and effectively prohibit non-stormwater discharges to the MS4.

3.3.1.5. Public Agency Activities Program

The Peninsula WMG agencies implement a Public Agency Activities Program to minimize stormwater pollution impacts from municipally owned or operated facilities and activities.

3.3.1.6. Public Information and Participation Program

An informed and knowledgeable community is crucial to the success of a stormwater management program[52]. The Peninsula WMG agencies implement a robust Public Information and Participation Program to distribute educational materials to the community and conduct outreach activities about the impacts of stormwater discharges on local waterbodies. The Peninsula WMG agencies currently implement the following targeted outreach programs:

- Landscape, Gardening and Pest Control Outreach
- Equestrian Community Outreach
- Domestic Pet Waste Outreach
- Residential Grey Water Education

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[50] Machado Lake Nutrient TMDL Implementation Plan

[51] United States Environmental Protection Agency. 2005. Stormwater Phase II Final Rule: Illicit Discharge Detection and Elimination Minimum Control Measure

[52] United States Environmental Protection Agency. 2005. Stormwater Phase II Final Rule: Public Education and Outreach Minimum Control Measure

3.3.1.7. Additional MCM Elements

In addition to the existing MCM programs being implemented by the Peninsula WMG, there are a number of new requirements outlined in the 2012 MS4 Permit that will be included in the Peninsula EWMP. These additional elements have the potential to considerably reduce pollutant loading to Peninsula EWMP Watersheds if properly implemented. The following is a brief summary of planned MCM control measures:

- Planning and Land Development Program: The 2012 MS4 Permit includes new requirements for low impact development and hydromodification control for new development and redevelopment projects. The Peninsula WMG agencies will also implement Green Streets Programs. These programs will provide source control of stormwater, limit its transport and pollutant conveyance to the collection system, restore pre-development hydrology to the maximum extent practicable, and provide environmentally enhanced roads.
- Public Agency Activities Program: The 2012 MS4 Permit requires the implementation of an Integrated Pest Management Program (IPM) through policies, procedures, and/ or ordinances and the development of an inventory of public facilities and retrofit opportunities.
- Development Construction Program: The 2012 MS4 Permit requires new erosion and sediment control practices for sites less than 1 acre a significant increase in inspections of construction sites.

3.3.1.8. Minimum Control Measure Customization

The MCM programs described in **Section 3.3.1** above are outlined in the MS4 Permit, and must be implemented per Permit specifications or customized through an approved EWMP[53]. The MS4 Permit provides the opportunity for agencies to evaluate the MCM programs and customize them to focus resources on the high priority water quality goals of their watersheds. Customization can include eliminating an MCM (with the exception of the Planning and Land Development Program, which cannot be eliminated), developing activities within an MCM to target specific water quality issues, and increasing or decreasing activities within an MCM. Reduced or eliminated MCM implementation must be justified with appropriate information to demonstrate the rationale for the modification.

The following steps should be taken to evaluate and customize MCMs:

- Develop list of MCM candidates for customization
  - Develop a list of additional MCMs required by the 2012 MS4 Permit which are not already being implemented;
  - Develop a list of MCMs currently being implemented above and beyond the 2001 MS4 Permit requirements, e.g., Clean Bay Restaurant Program;
  - Identify institutional/non-structural controls identified in TMDL implementation plans which may not yet have been implemented;
  - Develop a list of MCMs that are redundant, excessive in scope, or not effectively addressing a water quality priority;
  - Develop list of MCMs which are not applicable to the Peninsula WMG.
- Compile data and gather information to justify customizations

Customization can be justified in the following ways:

[53] Order No. R4-2012-0175 NPDES Permit No. CAS004001 Waste Discharge Requirements for Municipal Separate Storm Sewer System (MS4) Discharges within the Coastal Watersheds of Los Angeles County, except those Discharges Originating from the City of Long Beach MS4 Permit Section VI.D.

- If customized MCM effectiveness is greater than or equal to existing MCM effectiveness, customization can be justified.
- If an MCM requirement is not applicable, then elimination is justified.
- If additional resources required to implement the MCM are disproportionate to the increased effectiveness achieved, then discontinuation or reduction of the existing MCM may be justified.

Effectiveness assessments will be qualitative, and determined using available literature on pollutant sources, control measures and MCM implementation experience. The California Stormwater Quality Association (CASQA) Municipal Stormwater Program Effectiveness Assessment Guidance Document[54] outlines methods that stormwater managers can use to conduct program effectiveness assessments to determine whether programs are meeting desired outcomes. The CASQA Guidance Document defines outcomes as the "results of a control measure, program element, or overall program", and categorizes these outcomes into the following six outcome levels:

1. Implementation
2. Awareness
3. Behavior
4. Sources and Loads
5. Runoff Quality
6. Receiving Water Quality

Most effectiveness assessments currently conducted focus on activity-based outcomes (implementation, awareness, and behavior). The CASQA Guidance Document will be used to determine activity based outcomes and assess the effectiveness of the MCM programs where reliable data is available. A variety of resources will be evaluated to collect information on existing programs. These can include the NPDES Annual Reports, public outreach event attendance records, NPDES complaint records, inspection records, and other documentation regarding the implementation of MCM programs.

At this time, water quality based outcomes (sources, loads, runoff quality, and receiving water quality) resulting from program implementation are uncertain at best. Over time, however, being able to correlate water quality with activity-based outcomes will yield valuable information about the effectiveness of programs in addressing water quality priorities.

3.3.2 Existing Non-Structural Control Measures

Existing Non-Structural BMPs above and beyond MCM requirements are summarized below:

3.3.2.1. Water Efficient Landscaping Ordinance

The Peninsula WMG agencies implement and enforce water efficient landscaping ordinances to promote the design, installation, and maintenance of landscaping in a manner that conserves water resource and minimizes irrigation water runoff.

3.3.2.2. Horse Manure Management

[54] California Stormwater Quality Association. Municipal Stormwater Program Effectiveness Assessment Guidance. California: California Stormwater Quality Association: 2007

Where residential horse keeping is allowed, the Peninsula WMG agencies implement and enforce Horse Manure Management ordinances requiring the proper handling and disposal of horse manure to prevent its accumulation, runoff, or leaching.

3.3.2.3. Clean Bay Restaurant Program

The City of Rancho Palos Verdes, the largest of the Peninsula WMG agencies, implements a Clean Bay Restaurant Program to educate restaurants on clean restaurant practices, including proper disposal of wastes and spill prevention. The certification program recognizes food service establishments that receive a score of 100% on the program's criteria checklist by providing a window decal and public recognition from the Mayor.

3.3.2.4. Green Building Ordinance

The City of Rancho Palos Verdes, the largest of the Peninsula WMG agencies, implements a Green Building Construction ordinance that establishes incentives such as expedited plan review and fee reductions, and outlines procedures for participation in the city's voluntary green building program. This program encourages the design and development of single-family, multifamily residential, commercial, institutional and mixed-use projects that are sited, designed, constructed and operated to enhance the well-being of occupants, and to minimize negative impacts on the community and natural environment. In addition, all of the Peninsula WMG agencies have adopted or customized the 2010 California Green Building Standards Code.

3.3.2.5. Brake Pad Replacement

SB 346, which was adopted by the California legislation in 2010 and signed by the Governor on September 25, 2010, was enacted to establish a program to reduce copper use in brake pads. The passage of SB 346 is a milestone that will significantly reduce the level of copper in urban watersheds since vehicle brake pads constitute the single largest source of copper in metropolitan environments[55]. According to industry data on brake pad copper content, "SB 346 should reduce annual statewide copper emissions by more than 1.2 million pounds per year and should reduce brake pad copper levels by about 95%"[56]. The effects of this significant legislation will be considered during the development of the Peninsula EWMP.

3.3.3 Potential Non-Structural Control Measures

The following BMPs are additional Non Structural controls that will be considered for inclusion in the Peninsula EWMP. During EWMP development, results of the RAA analysis will help guide the extent of implementation of additional non-structural BMPs.

3.3.3.1. Enhanced Street Sweeping

Improved street and median sweeping technology enhances the potential for wet weather pollutant load reductions for bacteria, metals, non-metal toxics, and nutrients. Increasing the sweeping frequency, increasing the area of impervious cover swept, or upgrading the sweeping equipment can result in an increase in pollutant load removal[57]. During EWMP development, the Peninsula WMG will

[55] Moran, Kelly. 2011. Brake Pad Copper Reduction – MRP Section C.13.c. Report 2011
[56] Ibid.
[57] City of San Diego: San Diego River Watershed Comprehensive Load Reduction Plan – Appendix A: BMP Representation Summary (2012)

assess the possibility of increasing street sweeping frequency, area swept, and/or the upgrading of sweeping equipment.

3.3.3.2. Enhanced Catch Basin Cleaning Program

Enhancing the cleaning activities of catch basins can result in significant pollutant load reductions[58]. Increased frequency of cleaning operations is the best method for achieving pollutant load reductions from catch basins. The current Catch Basin Cleaning frequency for the Peninsula WMG agencies is summarized in Table 3-1.

Table 3-1 Current Catch Basin Cleaning Schedule

	City of Palos Verdes Estates		**City of Rancho Palos Verdes**		**City of Rolling Hills Estates**		**Unincorporated County**	
Current Catch Basin Cleaning Frequency	Priority C	1X/year	Priority C	1x/year	Priority A	4x/yr	Priority A	4x/yr
					Priority B	1x year (prior to wet season)	Priority B	2x year
					Priority C	1x/year (during dry season)	Priority C	1x/year

Priority A: High Trash Generating Catch Basins; Priority B: Moderate Trash Generating Catch Basins; Priority C: Low Trash Generating Catch Basins

3.3.3.3. Enhanced Irrigation Runoff Reduction Program

Reductions to irrigation runoff help to achieve runoff volume reduction and associated pollutant load reductions. This BMP, which doubles as a water conservation initiative, incorporates good landscaping practices to limit irrigation runoff. Measures to reduce irrigation runoff can be implemented wherever landscapes are irrigated. Residential, commercial, recreational, and industrial land uses can be targeted by incentive policies and programs. The Peninsula WMG agencies already implement Water Efficient Landscaping ordinances. Additional implementation methods to be considered during EWMP development might include:

- Municipal Landscape Retrofit Program to convert municipal landscaping to drought tolerant, low irrigation landscaping
- Turf Conversion Program to facilitate the conversion of lawns and gardens to drought tolerant, low irrigation landscaping

3.3.3.4. Targeted Outreach

The Peninsula WMG agencies currently implement robust Public Outreach Programs. Additional targeted outreach campaigns that will be considered during EWMP development include the following:

- Energy Efficiency Outreach to residents and businesses
- Low Impact Development (LID) Outreach to residents
- Fossil Fuel Reduction Outreach to residents
- Downspout Disconnection Outreach to residents

[58] Ibid.

- K-12 School Outreach

3.3.4 Existing and Planned Structural BMPs

Development of the EWMP will involve identifying a suite of structural BMPs that, when combined with non-structural BMPs (including the MCMs, Existing and Potential Non-Structural BMPs described in Sections 3.3.1-3.3.3), will have reasonable assurance of addressing the Peninsula WMG's Water Quality Priorities. The Peninsula WMG will evaluate multiple types of regional and distributed BMPs for inclusion in the EWMP. This section summarizes the existing and planned structural BMPs within the Peninsula WMG. Data was collected through a data request completed by the Peninsula WMG and by conducting a literature review of existing TMDL Implementation Plans and other planning documents. Existing BMPs described correspond to the structural BMP subcategories which are described in **Section 3.1.3.3**.

3.3.4.1. Existing and Planned Distributed Structural BMPs

The existing Distributed Structural BMPs within the Peninsula EWMP area are summarized in Table 3-2 below and shown in Figure 3-1. A full list of Existing and Planned Distributed Structural BMPs is included in Appendix 3.B.

Table 3-2 Summary of Existing and Planned Distributed BMPs

Jurisdiction*	Vegetated Swale	Biotreatment	Pretreatment	Bioretention	Detention	Permeable Pavers	Rainwater Harvesting	Infiltration	Diversion
RPV	8	2	95	12	3	2	-	-	-
PVE	-	-	-	-	-	-	-	-	-
RHE	3	1	35	-	-	6	-	3	1
Unincorporated County	-	-	-	4	-	-	2	-	-

*RPV-Rancho Palos Verdes, PVE-Palos Verdes Estates, RHE-Rolling Hills Estates

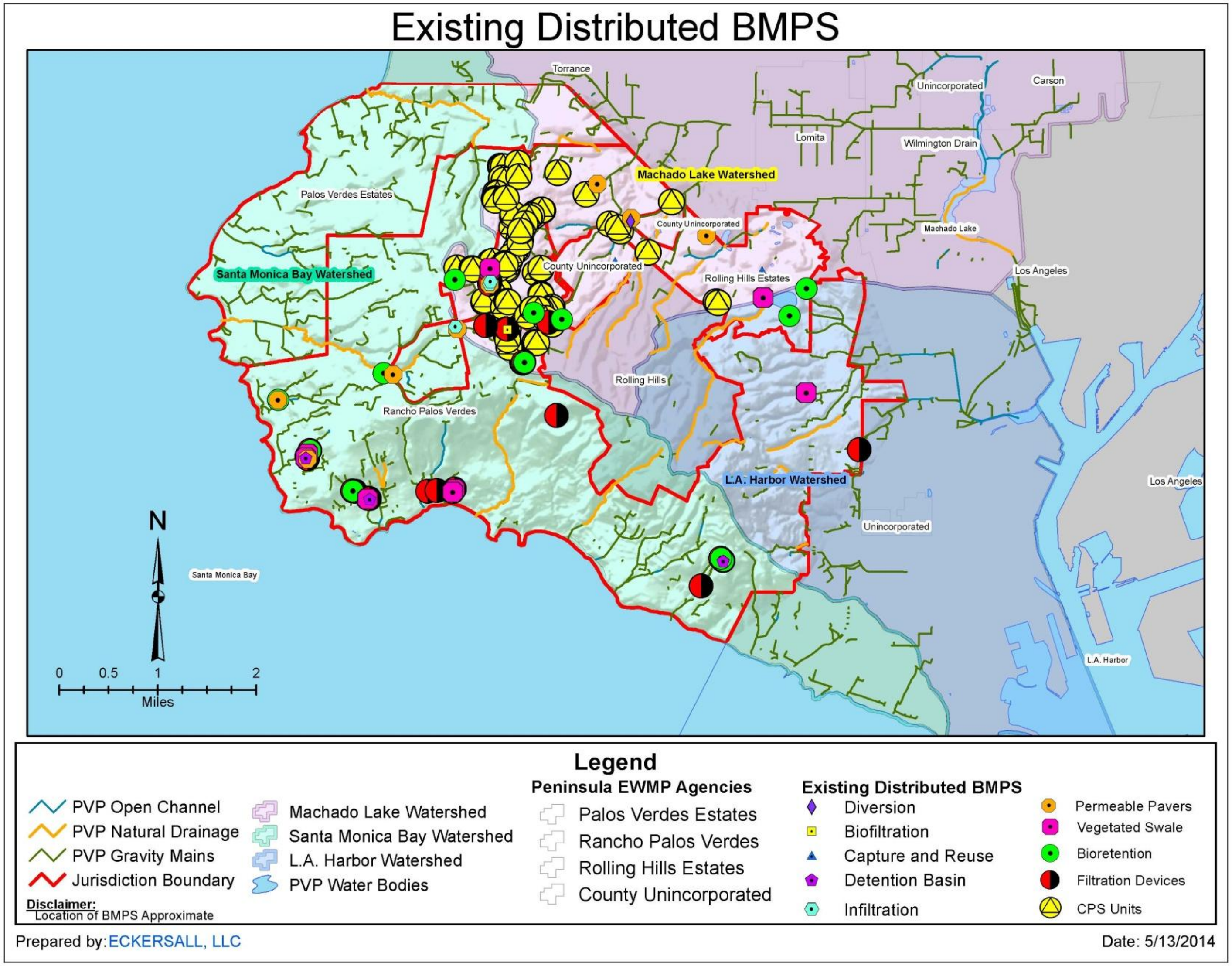

Figure 3-1 Existing Distributed BMPs

3.3.4.2. Existing and Planned Regional BMPs

A summary of existing and planned Regional BMPs[59] within the Peninsula EWMP area is summarized in Table 3-3 below and shown in Figure 3-2. More detail regarding existing and planned Regional BMPs is included in Appendix 3.B.

Table 3-3 Summary of Existing and Planned Regional BMPs

Project	Peninsula EWMP Project Number	Jurisdiction	Existing or Planned	Treatment Volume per Storm	Drainage Area to Project
Chandler Quarry Project	R1	RHE	Planned[(a)]	12.7 acre-feet[(b)]	707 acres
Butcher Ranch	R2	RHE	Existing	5.1 acre-feet[(c)]	28.62 acres
Malaga Cove Water Reuse	R3	PVE	Planned[(d)]	Unknown	Unknown
Abalone Cove Water Reuse	R4	RPV	Planned[(d)]	Unknown	Unknown
San Ramon Canyon	R5	RPV	Existing[(e)]	Unknown	Unknown

RPV-Rancho Palos Verdes, PVE-Palos Verdes Estates, RHE-Rolling Hills Estates
(a)Existing site planned to be redeveloped
(b) Based on the 50-year design storm
(c) Based on the 50-year design storm
(d)A feasibility study is currently being conducted for this project
(e) Project is currently under construction

[59] The term "Regional BMP" should be distinguished from "Regional EWMP BMP" as defined by the MS4 Permit (referred to herein as EWMP BMP). The MS4 Permit defines an EWMP BMP as a "multi-benefit regional projects that, wherever feasible, retain (i) all non-stormwater runoff and (ii) all stormwater runoff from the 85th percentile, 24-hour storm event for the drainage areas tributary to the projects, while also achieving other benefits including flood control and water supply, among others". Regional BMPs may not necessarily meet the MS4 Permit definition for an EWMP project; however, may still be included in the Peninsula EWMP as control measures implemented to meet water quality goals.

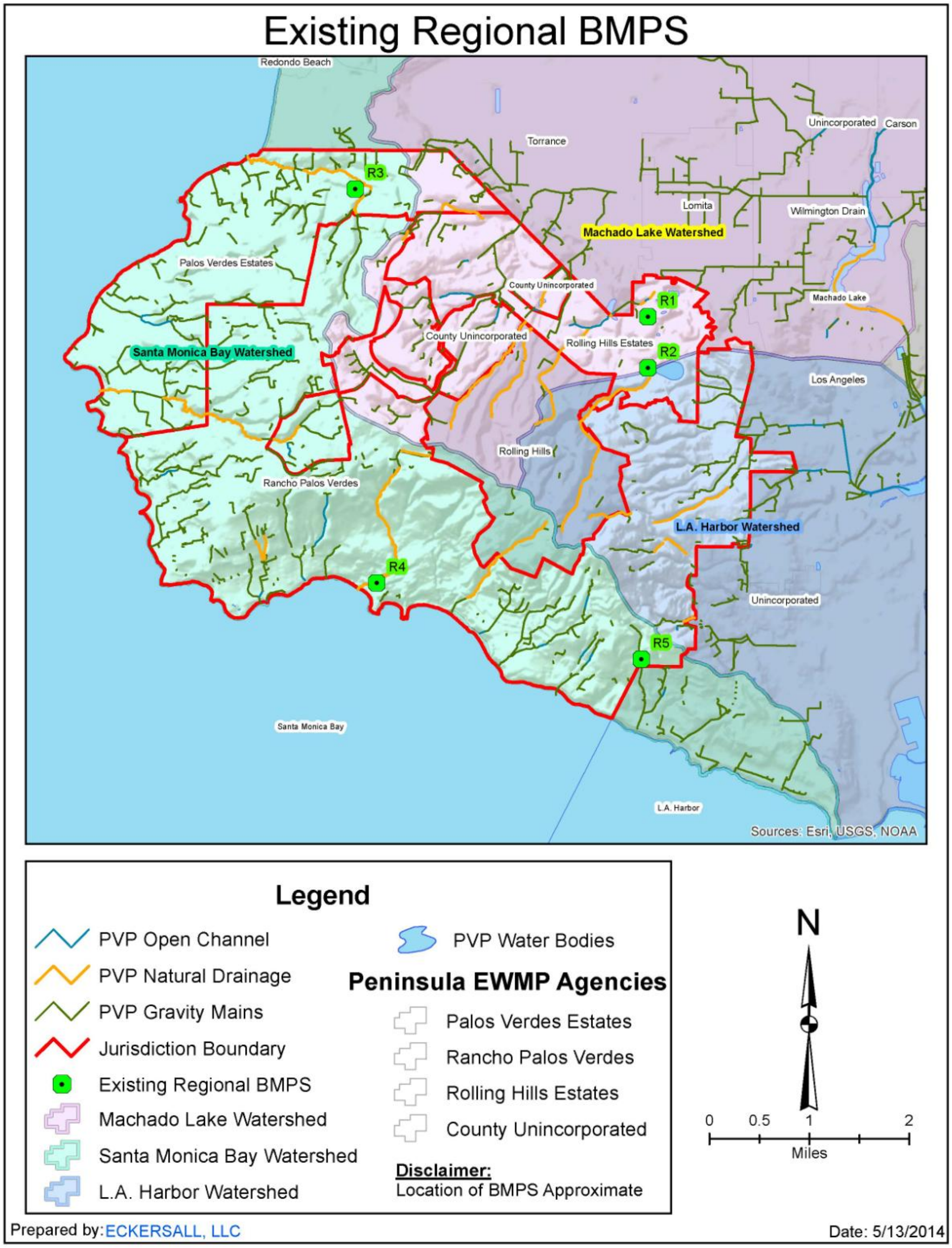

Figure 3-2 Existing and Planned Regional BMPs

3.4 Approach for Identifying and Evaluating Regional EWMP Projects

Participation in a EWMP requires collaboration among the participating agencies on multi-benefit regional projects that, wherever feasible, retain (i) all non-stormwater runoff and (ii) all stormwater runoff from the 85th percentile, 24-hour storm event for the drainage areas tributary to the projects, while also achieving other benefits including flood control and water supply, among others[60].

Existing Regional control measures along with additional Regional control measures identified during EWMP development will be evaluated for their suitability as Regional EWMP Projects. These projects will be analyzed using a combination of computer modeling and desktop-level screening to identify areas that are suitable for a Regional EWMP Project.

All potential Regional EWMP Projects will be evaluated (i.e., quantification of costs and water quality benefits) using the Structural BMP Prioritization and Analysis Tool (SBPAT). SBPAT leverages the strengths of the publicly available, Permit-approved, GIS-based SBPAT model that has been developed for the region[61]. SBPAT evaluates BMP performance based on a hydrologic/hydraulic assessment, a water quality evaluation, and a cost analysis. A more detailed description of the modeling process implemented by SBPAT will be provided in **Section 4: Reasonable Assurance Analysis (RAA) Approach**.

Stakeholders have identified an interest in evaluating regional water supply projects through the EWMP process. These types of projects will be considered and evaluated during EWMP development.

[60]Order No. R4-2012-0175 NPDES Permit No. CAS004001 Waste Discharge Requirements for Municipal Separate Storm Sewer System (MS4) Discharges within the Coastal Watersheds of Los Angeles County, except those Discharges Originating from the City of Long Beach MS4 Permit Section VI.C

[61] SBPAT is specifically referenced in the MS4 Permit Part VI.C.5.b.iv and was presented at the first two Permit Group TAC RAA Subcommittee meetings.

4. Reasonable Assurance Analysis Approach

The MS4 Permit requires that a Reasonable Assurance Analysis (RAA) be conducted for the waterbody-pollutant combinations addressed by the Peninsula EWMP (detailed in **Section 2**). The RAA will involve the identification and evaluation of potential BMP implementation scenarios with respect to the MS4 Permit-specified effluent and receiving water limits for the priority pollutants of concern for the Peninsula WMG. The RAA must demonstrate achievement of these effluent and receiving water limits for each waterbody-pollutant combination addressed in the Peninsula EWMP. The identification and numeric expression of these limitations are not addressed explicitly in this Work Plan, but will be included in other EWMP deliverables following approval of the EWMP Work Plan and will be evaluated as part of the final RAA.

This section summarizes the recommended modeling approach for conducting the RAA for the Peninsula WMG EWMP. The RAA approach presented herein conforms to Part VI.C.5.b.iv(5) of the MS4 Permit, which states:

> *Permittees shall conduct a Reasonable Assurance Analysis for each waterbody-pollutant combination addressed by the [EWMP]. [The] RAA shall be quantitative and performed using a peer-reviewed model in the public domain. Models to be considered for the RAA, without exclusion, are the Watershed Management Modeling System (WMMS), Hydrologic Simulation Program-FORTRAN (HSPF), and the Structural BMP Prioritization and Analysis Tool (SBPAT)…. The objective of the RAA shall be to demonstrate the ability of [the EWMP] to ensure that Permittees' MS4 discharges achieve applicable water quality based effluent limitations and do not cause or contribute to exceedances of receiving water limitations.*

In early 2014, the Regional Board also developed a guidance document titled, "Guidelines for Conducting Reasonable Assurance Analysis in a Watershed Management Program, Including an Enhanced Watershed Management Program." Although the guidance document presents guidelines and not necessarily strict requirements, the RAA approach presented herein has been developed to conform to the Regional Board guidance document where appropriate.

4.1. Model Selection for RAA Analysis

The recommended RAA approach leverages the strengths of the publicly available, MS4 Permit-approved, GIS-based SBPAT model program that has been developed for the region[62]. The following describes the rationale for utilization of this model for the RAA. A non-modeling based methodology is recommended for the dry weather RAA, described later in this section[63].

SBPAT is a public domain, "open source," GIS-based water quality analysis tool intended to: 1) facilitate the identification, prioritization, and selection of BMP project opportunities and technologies in urbanized watersheds; and 2) quantify benefits, costs, variability, and potential compliance risk associated with stormwater quality projects. The decision to use SBPAT for the Peninsula WMG RAA in the manner described below was partially based on the model capabilities and the unique characteristics of the Peninsula WMG, specifically:

[62] SBPAT is specifically referenced in the MS4 Permit Part VI.C.5.b.iv and was presented at the first two Permit Group TAC RAA Subcommittee meetings.

[63] A similar methodology will also be adhered to for wet weather for open beach compliance monitoring locations, where drainage areas are not defined and MS4 discharges are not immediately present.

1. **Modeling of SMB hydrologic and watershed processes** – SBPAT utilizes EPA's Stormwater Management Model (SWMM) as the hydrologic engine, and SBPAT has been calibrated to local rainfall and SMB streamflow gauges, confirming the ability to predict stormwater runoff volumes on an annual basis;
2. **SMB pollutants of concern and their compliance metric expression** – SBPAT has been utilized for planning applications related to Bacteria TMDL compliance (and specifically exceedance-day predictions, based on SMB criteria), including a demonstrated linkage of watershed bacteria loading to beach exceedance days;
3. **Availability of new open space water quality loading data** – Recently developed Event Mean Concentration (EMC) data are consistent with, and easily incorporated into, SBPAT and were developed in SMB as part of this RAA-development effort;
4. **Capability to conduct opportunity and constraints investigations** – SBPAT is capable of supporting structural BMP placement, prioritization, and cost-benefit quantification, and has been applied for such purposes previously in other SMB watersheds;
5. **Characterization of water quality variability** – SBPAT is capable of quantifying model output variability and confidence levels, which is a component of the Regional Board's recent RAA guidance; and
6. **Supports quantification of interim milestones, consistent with methods addressing both structural and non-structural BMPs** – SBPAT can model interim design scenarios by adjusting BMP input parameters to represent steps in BMP phasing. SBPAT can also model some non-structural wet weather BMPs, such as LID incentives and LID ordinance implementation for redevelopment projects.

The quantification analysis component of SBPAT includes a number of features. The model:

- Calculates and tracks inflows to BMPs, treated discharge, bypassed flows, evaporation, and infiltration at each 10 minute time step;
- Distinguishes between individual runoff events by defining six-hour minimum inter-event time in the rainfall record, yet tracks inter-event antecedent conditions;
- Tracks volume through BMPs and summarizes and records these metrics by storm event; and
- Produces a table of each BMP's hydrologic performance, including concentration and load metrics by storm event, and consolidates these outputs on an annual basis.

An example of the SBPAT (and EPA SWMM) hydrologic and watershed modeling approach is illustrated below in Figure 4-1.

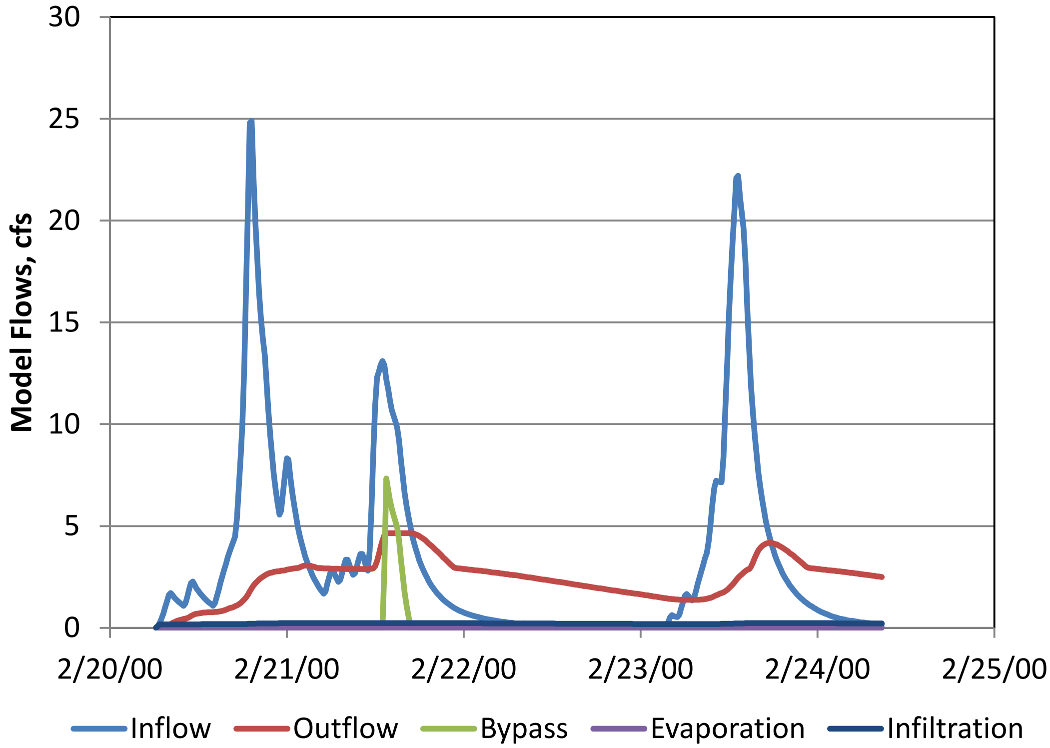

Figure 4-1 Example of SBPAT/SWMM Hydrologic Modeling Consideration of Storms in Long Term Record

Data used for the quantification/analysis module include both fixed and stochastic parameters. The model utilizes land use based EMCs, USEPA SWMM, USEPA/American Society of Civil Engineers/Water Environment Research Foundation (USEPA/ASCE/WERF) International BMP Database (IBD) water quality concentrations, watershed/GIS data, and a Monte Carlo approach to quantify water quality benefits and uncertainties. Model data flow is provided below in Figure 4-2.

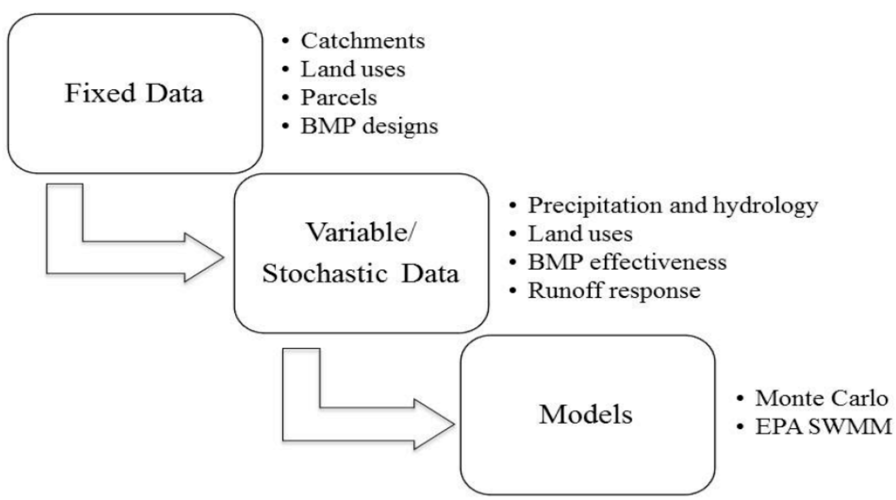

Figure 4-2 SBPAT Model Data Flow

Each model simulation integrates Monte Carlo methods that rely on repeated random sampling to obtain numerical results. Model simulations are typically run 20,000 times to calculate a distribution of outcomes that can support the definition of confidence levels and quantify variability. Consistent with the SBPAT usage, Monte Carlo methods are typically used in physical and mathematical problems and are most suited to be applied when it is difficult to obtain a closed-form expression or when a deterministic algorithm is not desired. A schematic of SBPAT's Monte Carlo process is provided in Figure 4-3. Model documentation, as well as links to related technical articles and presentations, is provided at www.sbpat.net.

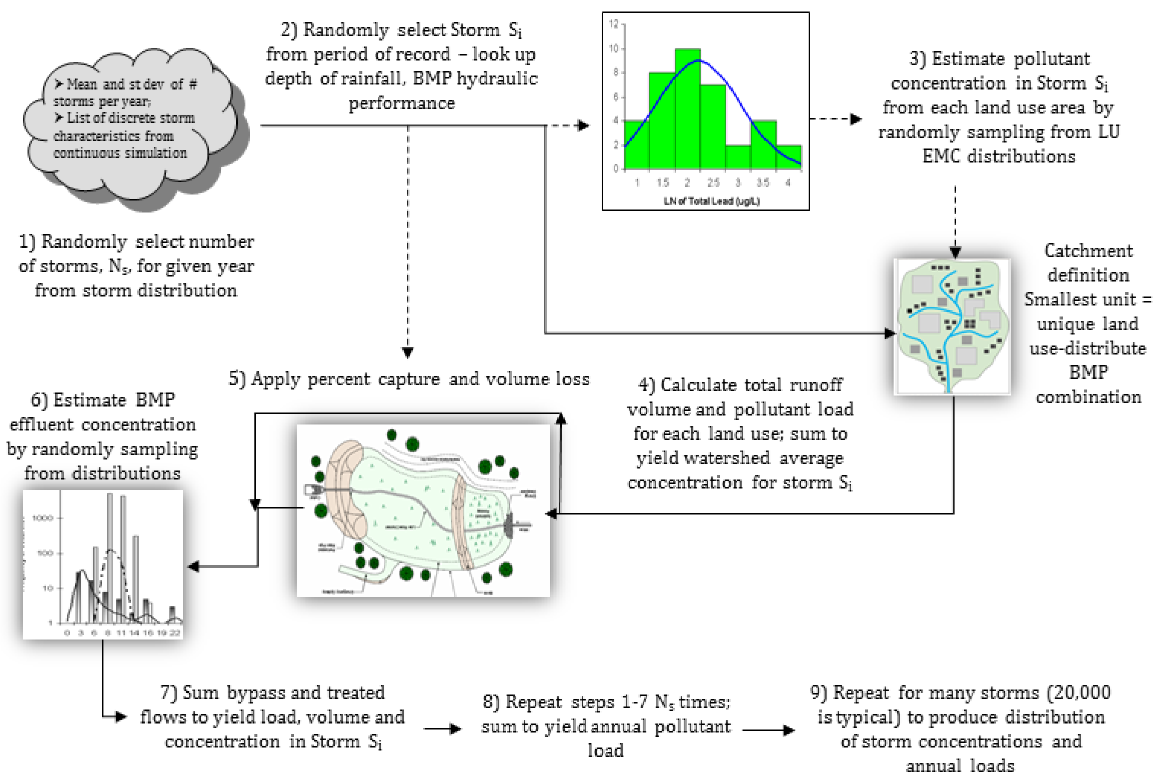

Figure 4-3 SBPAT Monte Carlo Method Components

4.2. Overview of RAA and BMP Selection Process

4.2.1. RAA Process

The RAA process, depicted in Figure 4-4, consists generally of the following steps:

- Identify waterbody-pollutant combinations for which the RAA will be performed (these will be identified in TM 2.1);
- Identify the MS4 service area (exclude lands of agencies not party to this EWMP such as City of Rolling Hills, State land, etc.);
- Develop target load reductions for the 90th percentile year (1995) based on Regional Board guidance;

- Identify structural and non-structural BMPs that were either implemented after applicable TMDL effective dates or are planned for implementation in the future;
- Evaluate the performance of these BMPs in terms of annual pollutant load reductions;
- Compare these estimates with the targets; and
- Revise the BMP implementation scenario until targets are met.

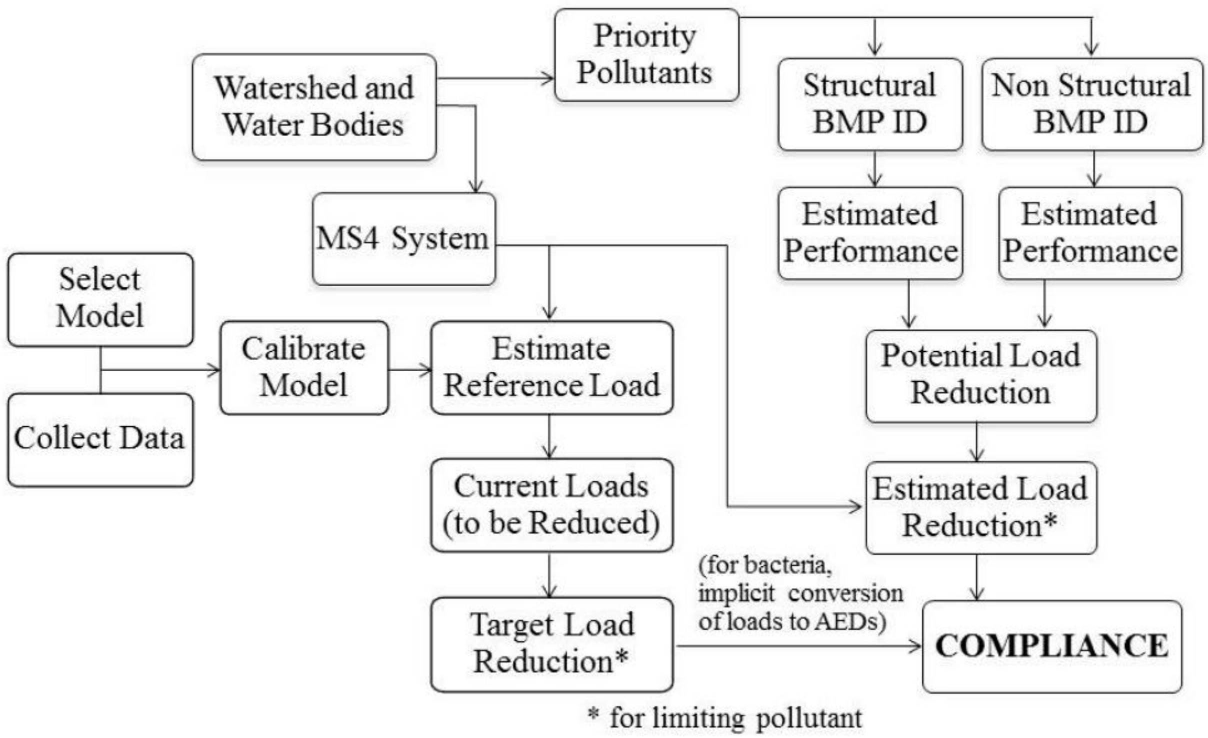

Figure 4-4 RAA Process Overview for Peninsula WMG Watersheds

Target load reductions represent a numerical expression of the MS4 Permit compliance metrics (e.g., bacteria allowable exceedance days [AEDs] for dry and wet weather) that can be modeled and can serve as a basis for confirming that the Peninsula EWMP is in compliance with the MS4 Permit and that the efforts described therein, if appropriately implemented, will reasonably demonstrate and assure MS4 Permit compliance.

Specifically for bacteria in the SMB Watershed, allowable exceedance days at each SMB Beaches Bacteria TMDL compliance monitoring location are anti-degradation-based. As a result, a target load reduction of zero will be assumed for each subwatershed tributary to these compliance monitoring locations[64], consistent with the TMDL's approach that acknowledges that historic bacteria exceedance rates for each of these subwatersheds are lower than that of the reference beach, on average.

For bacteria in the Wilmington Drain (Machado Lake) Subwatershed, target load reductions will be established through the following steps, which are based on the reference system approach[65]:

[64] Anti-degradation compliance monitoring stations included in the SMB Beaches Bacteria TMDL include SMB 7-1, 7-2, 7-3, 7-4, and 7-5.

[65] Although Wilmington Drain is currently without a TMDL, since it is 303(d)-listed for bacteria, its targets will be developed consistent with reference system allowable exceedance approaches implemented for the Los Angeles

- Calculate the subwatershed's baseline (natural condition) loading, assuming the land use distribution of the Arroyo Sequit subwatershed (approximately 95% open space) to represent an "allowable" annual load that reflects the reference condition;
- Calculate "existing" (pre-EWMP implementation) loading using existing land uses and BMPs to represent the current load; and
- Subtract the two load estimates to determine the target load reduction needed to achieve reference watershed conditions.

This approach for bacteria requires a new open space land use event mean concentration (EMC) dataset for fecal coliform that reflects wet weather freshwater samples collected from the SMB reference watershed, Arroyo Sequit[66]. This new open space EMC dataset is shown in Table 4-1.

Table 4-1 Default and revised fecal coliform EMC statistics for open space/vacant land use category (arithmetic estimates of log mean and log standard deviation values shown)

	Mean (MPN/100 mL)	**Standard Deviation (MPN/100 mL)**
SBPAT Default based on Southern California Coastal Watershed Research Project (SCCWRP) 2007b (n=2)	6310	1310
Revised based on Arroyo Sequit samples (n=11)	484	806

The above approach describes one method for demonstrating reasonable assurance for bacteria limits. Alternatively, fecal coliform target load reductions can also be estimated using an SBPAT modeling approach where a hypothetical infiltration basin at each subwatershed outlet is sized so that discharge frequency meets the AEDs, with the target load reduction values then set equivalent to the load reduction achieved by the hypothetical outlet infiltration basin.

In the Los Angeles Harbor and Machado Lake Watersheds (including Wilmington Drain), target load reductions for non-bacteria pollutants will be established using SBPAT's watershed model for the following TMDL pollutants: TSS, total nitrogen (nitrate, ammonia, and TKN), total phosphorus, total copper, total lead, and total zinc[67]. Land use loading will be reduced in SBPAT until daily average pollutant concentrations at the compliance modeling locations meet concentration-based or mass-based targets based on the water quality based effluent limitations (WQBELs) or receiving water

region freshwater TMDLs. Wilmington Drain has a REC-1 beneficial use designation and no High Flow Suspension; therefore it is comparable with reference streams in this regard.

[66] Arroyo Sequit is one of the reference stream datasets that are included in the Los Angeles region creek and river TMDLs. The reference stream dataset is the basis for the 19% average allowed exceedance rate that is used for wet weather in these TMDLs.

[67] Due to limitations in the amount of pollutants which can be modeled in SBPAT, surrogate pollutants will be used for the waterbody-pollutant priorities established in Section 2 (e.g., copper, lead, and zinc will be used as a surrogate for mercury; TSS will be used as a surrogate for toxicity and other sediment-bound pollutants; and total nitrogen will be used as a surrogate for algae, eutrophic, etc.)

limitations (RWLs). The resulting load reductions, expressed as percentages of baseline loads, will become the target load reductions that BMP benefits will be modeled against in SBPAT.

Zero target load reductions will be set for PCBs and DDT, consistent with the USEPA TMDL which sets MS4 waste load allocations based on existing loads. Their anticipated BMP load reductions will be reported based on TSS, which is assumed to be a representative surrogate for these particulate-associated pollutants.

4.2.2. BMP Selection Process

The RAA modeling process will begin with the evaluation of new or enhanced, quantifiable non-structural BMPs and existing structural BMPs to assess water quality improvements (load reductions) which have occurred to date since the effective dates of applicable TMDLs. Next, if compliance is not met based on non-structural and existing BMPs, planned non-structural and structural BMPs will be modeled with consideration of scheduled completion in the context of the prioritized waterbody-pollutant combinations and compliance deadlines (including interim milestone dates). If compliance is still not achieved by the combination of both built and planned BMPs, additional BMPs will be discussed with the Peninsula WMG Agencies in order to achieve compliance. These BMPs will be selected based on pollutants targeted, siting options, and maintenance preferences, among other criteria. Further details of this BMP selection process are provided in **Section 3**. The BMP prioritization tool within SBPAT will be used to assist in this process. This tool first prioritizes catchments based on pollutant loads relative to downstream water impairments and TMDLs, identifies parcels with the greatest opportunities for structural BMP implementation, ranks BMP options based on cost, effectiveness, ease of implementation, and other user-defined benefits/impacts, and lastly takes into consideration site-specific fatal flaws.

The water quality priorities defined in **Section 2** will be the emphasis of the RAA analysis, which will focus on quantifiable MS4-derived pollutants.

4.2.3. Scheduling

There is a need for linking RAA outcomes to interim and final TMDL compliance dates. The steps described in **Sections 4.2.1 and 4.2.2** are developed for final TMDL compliance. Once the BMP implementation approach is developed for final compliance, specific activities and the potential scheduling of said activities will be established within the context of local opportunities and constraints. It is expected that to assess compliance with interim milestones, the RAA analysis will need to be implemented for interim BMP implementation scenarios. These are expected to include different levels of non-structural BMPs, implemented over time (e.g., LID ordinance implementation). It is also recognized that in some cases there will be overlapping implementation efforts (e.g., non-structural outreach BMPs in areas where there are also structural BMPs). These instances will be evaluated on a case-by-case basis so that double-counting of water quality benefits is avoided.

Quantifiable non-TMDL (or non-303(d)) pollutants can also be addressed using SBPAT, but these pollutants may not include a reference to a target load reduction; i.e., their quantification would only serve to express the additional water quality benefits of the existing, planned, and proposed BMPs.

4.2.4. Uncertainty and Variability

The proposed RAA approach, which directly utilizes monitoring data to characterize natural variability, as well as Monte Carlo methods to develop stochastic relationships, is conducive to the production of metrics that quantify variability and confidence limits (which reflect the uncertainty of predicted output, such as average annual loads). These relationships are important in determining the level of BMP implementation and for the regulatory agencies to assess reasonableness. The SBPAT methods can provide statistics annualized over a longer period of record (e.g., 10-years) or can be conducted for numerous individual years. The structural BMP methodologies described herein are also easily paired with non-structural BMP quantification methods.

4.3. Wet Weather Modeling Approach

4.3.1. Spatial Domain

The spatial domain of the RAA will include the priority catchments within the Peninsula WMG area, excluding drainage areas already addressed by regional EWMP projects (as defined in **Section 3**). Adjustments may be made to account for contributions from agencies not party to this EWMP (e.g., Rolling Hills, State, Federal, etc.).

GIS layers to be used in SBPAT will include the following:

- Soils
- Catchments/subbasins
- Topography
- Impairments (TMDLs/303(d))
- Land use
- Watershed
- Rain gage polygons
- Storm drains
- Parcels

Other shapefiles such as BMP locations and BMP drainage areas will be used to extract background information, rather than as direct inputs to the model.

4.3.2. Hydrology

SBPAT utilizes a customized version of SWMM for continuously simulating study area hydrology and BMP hydraulics. Long-term, hourly rainfall data and average monthly evapotranspiration values are used along with land use-linked catchment imperviousness and soil properties to estimate runoff volumes. Revised and recalibrated SBPAT database values and EWMP-defined BMP information are used to estimate the volume of runoff generated from watershed areas and captured by BMPs. Storm events are individually tracked for the entire simulation so that the volumes of runoff infiltrated, evapotranspired, captured, and released (if applicable) by BMPs are estimated for every storm event.

4.3.2.1. Calibration

The hydrology component of SBPAT was calibrated for SMB based on data for Topanga Creek, a HUC-12 subwatershed located within the eastern portion of the North Santa Monica Bay Coastal Watersheds. Since primary output for SBPAT includes annual volumes and pollutant loads, the calibration focused on accurate prediction of annual discharge volumes based on hourly rainfall data, as compared with stream flow data. The effective impervious percentage for the open space land use category and the saturated hydraulic conductivity of all mapped soil types served as calibration parameters. The resulting input parameter value adjustments are shown in Tables 4-2 and 4-3, respectively. Saturated hydraulic conductivities for all soil types were adjusted to the lower end of the allowable range from the U.S Department of Agriculture National Engineering Handbook (2009). Figure 4-5 is a depiction of the hydrologic calibration results. The emphasis of the calibration effort focused on accurate, unbiased prediction of "non-extreme" annual conditions (i.e., annual volumes exceeding a 25-year return interval, 4% probability, were excluded from the calibration effort). Based on available data, the period of calibration was 7 years, between 2005 and 2011, with water year 2007 excluded due to outlying streamflow measurement results. The calibrated input parameter values will be used for the Peninsula WMG RAA.

Table 4-2 SBPAT Calibration Adjustments: Effective Imperviousness

	Effective Impervious Percent	
Land Use	**Default**	**Calibrated**
Vacant/Open	1%	10%

Table 4-3 SBPAT Calibration Adjustments: Saturated Hydraulic Conductivity

	Saturated Hydraulic Conductivity[68] (in/hr)	
Los Angeles County Soil Number	**Default**	**Calibrated**
2	0.11	0.06
22	0.35	0.2
24	1.26	0.6
25	0.15	0.06
26	3.6	2
27	0.64	0.6
30	0.72	0.6
33	0.51	0.06
35	1.5	0.6
38	0.5	0.06
66	0.29	0.2

[68] U.S. Department of Agriculture (USDA), 2009. National Engineering Handbook (210-VI-NEH), Chapter 7. Natural Resource Conservation Service.
http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=22526.wba

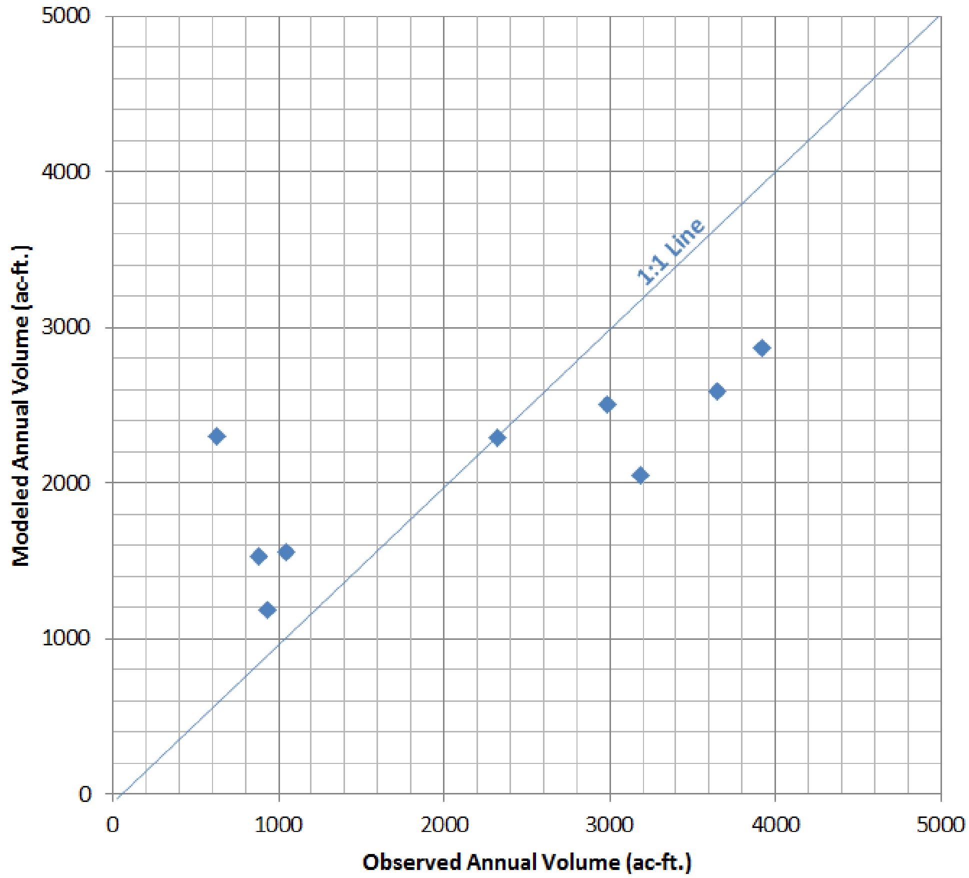

Figure 4-5 Annual Runoff Volumes for SMB Calibration: Modeled vs. Observed

Following calibration, average prediction error (or the average of the percent differences between each observed and modeled annual runoff volume) was calculated to be 2%. The Regional Board's RAA Guidance Document (which is based on Donigian, 2000) lists the SBPAT model performance with respect to hydrology in the "very good" category.

4.3.3. Water Quality

As described in **Section 2**, the priority waterbody-pollutant combinations for the Peninsula WMG EWMP area, combined with data availability, will dictate which waterbody-pollutant combinations the RAA will prioritize.

As previously described, SBPAT links the long-term hydrologic output from SWMM to a stochastic Monte Carlo water quality model to develop statistical descriptions of stormwater quantity and quality. Through this approach, the predicted runoff volumes for each storm are randomly sampled from the long-term storm event runoff volume record produced by SWMM. Land use-based wet weather pollutant EMC values (see Table 4-4 for summary statistics and Appendix 4.A for a data summary) and BMP effluent concentrations (presented in **Section 3**) for each storm are then randomly sampled from their lognormal statistical distributions. The runoff volumes (including volumes treated and bypassed by BMPs), land use EMCs, and BMP effluent concentrations are combined to determine the total pollutant loads and load reductions (i.e., difference between existing and post-BMP load estimates) for each randomly sampled storm event. This procedure is then repeated thousands of times, each time recording the volume, pollutant concentrations, loads, and load reductions for each randomly selected storm event. The statistics of these recorded results are then used to characterize the low (25th percentile), average (mean), and high (75th percentile) values for the annual volume, pollutant loads, and pollutant concentrations in stormwater runoff from the modeled area, with and without BMPs implemented.

Table 4-4 Proposed SBPAT EMCs for Peninsula WMG Watersheds – Arithmetic Estimates of the Lognormal Summary Statistics (means with standard deviations in parentheses)[a]

Land Use	TSS mg/L	TP mg/L	DP mg/L	NH3 mg/L	NO3 mg/L	TKN mg/L	Diss Cu ug/L	Tot Cu ug/L	Tot Pb ug/L	Diss Zn ug/L	Tot Zn ug/L	Fecal Col. #/100mL
Single Family Residential	124.2 (184.9)	0.40 (0.30)	0.32 (0.21)	0.49 (0.64)	0.78 (1.77)	2.96 (2.74)	9.4 (9.0)	18.7 (13.4)	11.3 (16.6)	27.5 (56.2)	71.9 (62.4)	31,100[b] (94,200)
Commercial	67.0 (47.1)	0.40 (0.33)	0.29 (0.25)	1.21 (4.18)	0.55 (0.55)	3.44 (4.78)	12.3 (10.2)	31.4 (25.7)	12.4 (34.2)	153.4 (96.1)	237.1 (150.3)	51,600 (173,400[c])
Industrial	219.2 (206.9)	0.39 (0.41)	0.26 (0.25)	0.6 (0.95)	0.87 (0.96)	2.87 (2.33)	15.2 (14.8)	34.5 (36.7)	16.4 (47.1)	422.1 (534.0)	537.4 (487.8)	3,760 (4,860)
Education (Municipal)	99.6 (122.7)	0.30 (0.17)	0.26 (0.2)	0.4 (0.99)	0.61 (0.67)	1.71 (1.13)	12.2 (11.0)	19.9 (13.6)	3.6 (4.9)	75.4 (52.3)	117.6 (83.1)	11,800[d] (23,700)
Transportation	77.8 (83.8)	0.68 (0.94)	0.56 (0.82)	0.37 (0.68)	0.74 (1.05)	1.84 (1.44)	32.40 (25.5)	52.2 (37.5)	9.2 (14.5)	222.0 (201.7)	292.9 (215.8)	1,680 (456)
Multi-Family Residential	39.9 (51.3)	0.23 (0.21)	0.20 (0.19)	0.50 (0.74)	1.51 (3.06)	1.80 (1.24)	7.40 (5.70)	12.1 (5.60)	4.5 (7.80)	77.5 (84.1)	125.1 (101.1)	11,800[e] (23,700)
Agriculture (row crop)	999.2 (648.2)	3.34 (1.53)	1.41 (1.04)	1.65 (1.67)	34.40 (116.30)	7.32 (3.44)	22.50 (17.50)	100.1 (74.8)	30.2 (34.3)	40.1 (49.1)	274.8 (147.3)	60,300 (153,000)
Vacant / Open Space	216.6 (1482.8)	0.12 (0.31)	0.09 (0.27)	0.11 (0.25)	1.17 (0.79)	0.96 (0.9)	0.60 (1.90)	10.6 (24.4)	3.0 (13.1)	28.1 (12.9)	26.3 (69.5)	484[f] (806)

[a] EMC statistics are calculated based on 1996-2000 data for Los Angeles County land use sites (Los Angeles County, 2000), except for agriculture which are based on Ventura County MS4 EMCs (Ventura County, 2003) and fecal coliform which are based on 2000-2005 SCCWRP Los Angeles region land use data (SCCWRP, 2007b). These EMC datasets are summarized in the SBPAT User's Guide (Geosyntec, 2012).

[b] The fecal coliform EMC for the single-family residential land use is based on SCCWRP dataset for "low-density residential."

[c] The default log distribution best fit summary statistics for this land use-pollutant combination produced an unreasonably high deviation, therefore the arithmetic estimate of the log mean was held constant while the log summary statistics were recomputed based on the log CoV for SFR (SCCWRP's LDR EMC).

[d] Multi Family Residential EMC used since educational land use site not available in the SCCWRP fecal coliform dataset.

[e] The fecal coliform EMC for the multi-family residential land use is based on SCCWRP dataset for "high-density residential."

[f] Open space fecal coliform EMC statistics based on *E. coli* data (divided by 0.85 to adjust to fecal coliform) for Arroyo Sequit reference watershed, or 11 samples collected between December 2004 and April 2006. Data used by Regional Board for Santa Clara River Bacteria TMDL and taken from (SCCWRP, 2005) and (SCCWRP 2007a).

For bacteria modeling, verifying the linkage between modeled *fecal coliform loads* (i.e., discharged from the watershed outlets) and total observed wet weather *exceedance days* (in the ocean, based on REC1 daily maximum water quality objectives) is critical to establish reasonable assurance that the ocean monitoring locations will be in compliance with the MS4 Permit limits for the SMB Beaches Bacteria TMDL. To establish this linkage, an analysis was conducted using shoreline monitoring data at Topanga Canyon[69] (SMB 1-18) between 2005 and 2013. Figure 4-6 illustrates a reasonable correlation between modeled annual fecal coliform loads and observed annual exceedance days.

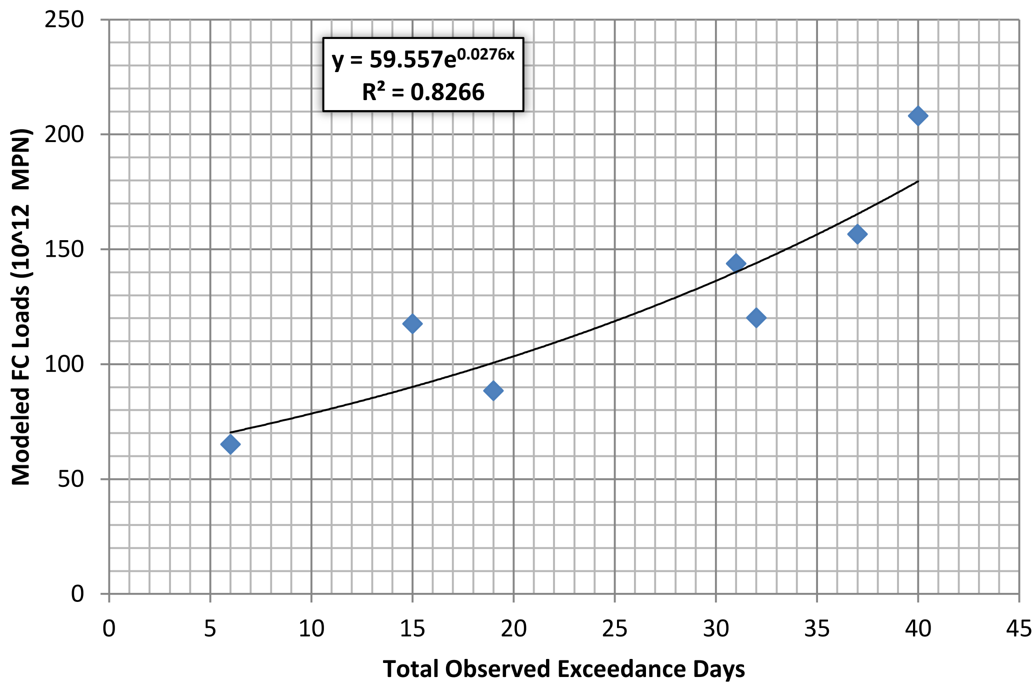

Figure 4-6 Correlation between Modeled Fecal Coliform Loads

[69] This watershed is 88% open space. This is a daily sampled compliance shoreline monitoring site.

4.3.4. *Representation of Individual BMPs*

SBPAT will be used to model all BMPs in the Peninsula WMG to meet the target load reductions, both in the SMB Watershed as well as the Dominguez Channel Watershed Management Area.

4.3.4.1. Data to Support Model Set-Up

The International Stormwater BMP Database (IBD) is a comprehensive source of BMP performance information (www.bmpdatabase.org), comprised of data from a peer-reviewed collection of studies that have monitored the effectiveness of a variety of BMPs in treating water quality pollutants for a variety of land use types. Water quality performance data from the IBD were used to develop effluent concentrations (averages and standard deviations) of the BMPs and constituents listed in Table 4-5. A more detailed discussion of the BMP modeling data is provided in **Section 3**.

As with land use EMCs, the effluent quality of BMPs is highly variable. To account for this variability in SBPAT, effluent quality data were analyzed and descriptive statistics were generated for use in the Monte Carlo statistical sampling technique. A more detailed discussion of the BMP modeling data is provided in **Section 3**.

Table 4-5 BMPs and Constituents Modeled[a]

BMPs	Constituents
Constructed Wetland / Retention Pond (with Extended Detention)	Total suspended solids (TSS)
Constructed Wetland / Retention Pond (without Extended Detention)	Total phosphorus (TP)
Dry Extended Detention Basin	Dissolved phosphorus as P (DP)[b]
Hydrodynamic Separator	Ammonia as N (NH3)
Media Filter	Nitrate as N (NO3)
Subsurface Flow Wetland	Total Kjeldahl nitrogen as N (TKN)
Treatment Plant	Dissolved copper (DCu)
Bioswale	Total copper (TCu)
Bioretention with underdrain	Total lead (TPb)
Bioretention (volume reduction only)	Dissolved zinc (DZn)
Cistern (volume reduction only)	Total zinc (TZn)
Green Roof (volume reduction only)	Fecal Coliform (FC)
Porous Pavement (volume reduction only)	
Low Flow Diversion (volume reduction only)	

[a] All constituents are addressed for all BMPs that provide treatment (i.e., excluding those identified as "volume reduction only").

[b] Dissolved phosphorus and orthophosphate datasets were combined to provide a larger dataset and because the majority of orthophosphate is typically dissolved and many datasets either report dissolved phosphorus or orthophosphate, but not both.

4.3.4.2. MCMs and other Non-Structural BMPs

Existing, recently-initiated non-structural BMPs (i.e., those not modeled in the initial establishment of the TMDLs and compliance requirements) and planned non-structural BMPs will be evaluated in terms of ability to reduce loads at each of the compliance modeling locations within the Peninsula WMG area. Both wet and dry weather water quality benefits of these BMPs will be evaluated for all TMDL and 303(d) pollutants (excluding trash) where data are available to support such estimates.

Non-structural BMPs will be quantified with assumptions and references documented. For example, bacteria and dry weather runoff reduction BMPs will be quantified consistent with methodologies utilized in recent San Diego Combined Load Reduction Plans (examples available at http://www.sbpat.net/example.html). Figure 4-7 shows a general schematic of non-structural BMP load reduction quantification through an example using pet waste programs.

4.3.4.3. Structural BMPs

The goal of this step will be to achieve the remaining target load reductions by utilizing structural BMPs in combination with the benefits of non-structural BMPs. The RAA will consider existing jurisdictional, sub watershed, and conveyance facility characteristics to delineate pollutant source, runoff control, and outfall monitoring strategies. This will involve a detailed review of existing conditions and datasets. This step will include the following components:

- Existing (i.e., implemented post-TMDL) and planned structural BMPs, which are identified in **Section 3**, will be described by the Peninsula WMG agencies with sufficient conceptual design detail to support quantitative analysis. Based on agency input on BMP preferences, additional "proposed" structural BMP opportunities may be identified and prioritized using SBPAT's structural retrofit planning methodology, and these potential projects will be reviewed by the Peninsula WMG agencies prior to RAA modeling. The final TMDL compliance scenario will reflect the dates in which the final TMDL limits become effective[70].
- The water quality benefits (in terms of expected pollutant load reductions) associated with existing, planned, and proposed structural BMPs will be evaluated using SBPAT, as described previously in this section.

4.3.5. Representation of Cumulative Effect of all BMPs and New BMP Selection Support

Following evaluation of the water quality benefits associated with non-structural and structural BMPs, additional pollutant load reductions necessary to achieve the target load reductions will be calculated to determine whether additional BMPs are needed to demonstrate reasonable assurance (see Figure 4-4). To avoid double-counting of load reductions where non-structural and structural BMPs overlap (e.g., for a catchment where irrigation overspray reduction programs will be targeted and a downstream diversion to a regional BMP exists), the greater load reduction of each BMP will be applied, but load reductions will not be additive.

Estimated load reductions will be compared with the target pollutant load reductions and, for bacteria, will represent exceedance day-based compliance demonstration. Expected pollutant reduction ranges will be provided, thereby capturing the variability inherent to precipitation patterns, land use runoff concentrations, and BMP performance. The Peninsula WMG Agencies may then use discretion, based on their specific compliance risk tolerance, to interpret "reasonable assurance" based on a number of statistical options, such as whether the target annual load reductions (which may correspond to a TMDL critical condition, such as a 90th percentile wet year) are met by the predicted average or 75th percentile annual load reductions (i.e., there is a 25% probability of compliance based on the modeling analysis). It is recognized that the Technical Advisory Committee and/or its RAA subcommittee may also express preferences or guidance for how such model output are reported. Figure 4-7 depicts an example of a phased implementation approach to reach the desired target load reduction. In the case that BMPs address several pollutants simultaneously, this process will be evaluated for the limiting pollutant.

[70] TMDL compliance dates are summarized in **Section 2 Water Quality Priorities**.

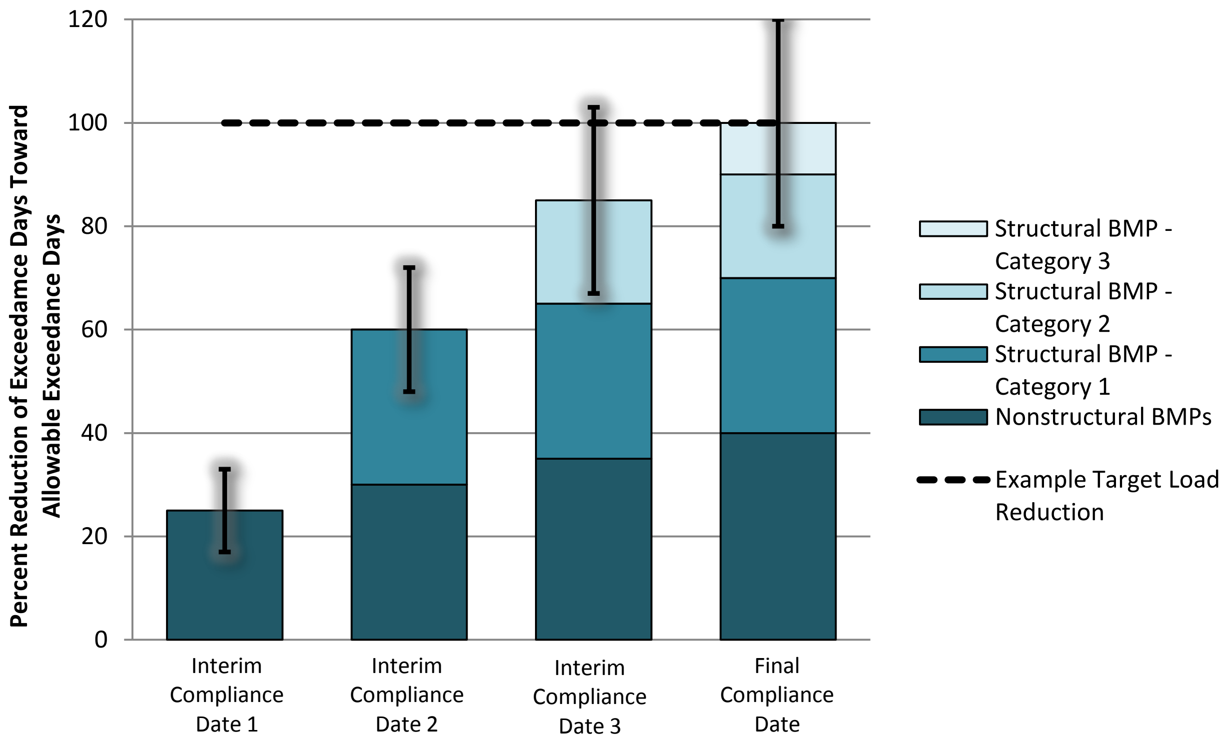

Figure 4-7 Conceptual Approach to Phased Implementation

4.3.6. *Regional EWMP Project (85th Percentile Design) Definition*

Regional EWMP projects meeting the 85th percentile design basis negate the need for RAA on their drainage areas. This design criterion can be met in a variety of ways. The simplest approach would be to design a single structural BMP to retain the 85th percentile, 24-hour design volume, which may be computed using the County's Modified Rational Method and design hydrology processes. This approach is the easiest to design, but the most difficult to construct due to the required facility capacity, land availability, and operations and maintenance constraints, among numerous other factors. An alternate approach to retain the 85th percentile storm would be to incorporate and account for the impacts of a combination of distributed BMPs upstream of the regional BMP. This would result in the effective design capacity of the regional BMP increasing over time as distributed BMPs are progressively implemented. Lastly, it may also be possible to meet the 85th percentile design criteria at a smaller regional BMP by incorporating a real-time controller in combination with infiltration and/or capture and use systems. This more innovative approach may require assumptions of different disposal options as future non-structural BMPs.

4.4. Dry Weather RAA Approach

Demonstrating "reasonable assurance" of compliance with dry weather numeric targets for waterbody-pollutant combinations in the Peninsula WMG requires a methodology that accounts for many factors which cannot be modeled in SBPAT. Therefore, to perform the RAA for dry weather for the Peninsula WMG area, a semi-quantitative methodology has been developed to follow a permit compliance structure. Because fecal indicator bacteria are considered the "controlling" pollutants of concern during dry weather in the SMB portion of the Peninsula WMG (i.e., if MS4 discharges are compliant for bacteria during dry weather, they will be compliant for all TMDL and 303(d) pollutants during dry weather), the methodology was developed based on bacteria. At this time there are no other numeric targets applicable only during dry weather within the Peninsula WMG – targets for nutrients in Machado Lake and toxics in Machado Lake and the Greater LA Harbor are set regardless of weather conditions. The following series of questions form the proposed dry weather RAA methodology. Each question is to be answered for each Coordinated Shoreline Monitoring Plan (CSMP) compliance monitoring location (CML). If one question is affirmative then "reasonable assurance" is considered to be demonstrated. This methodology is illustrated in Figure 4-8.

1. For bacteria only, have the allowed dry weather (summer and winter) single sample exceedance days been met based on monitoring data from recent years? To avoid making costly BMP investments based on outlier years, four out of the five most recent years may be used to evaluate this criterion. For other pollutants, have the TMDL monitoring locations been in compliance during dry weather for four of the past five years?
2. Are there no MS4 outfalls owned by the Peninsula WMG Agencies within the CML's drainage area, and therefore MS4 discharges could not be contributing to pollutant concentrations at the CML?
3. Are the allowed dry weather (summer and winter) single sample exceedance days based on an antidegradation approach at the CML?
4. Is a dry weather diversion or disinfection system located at the CML? To meet this criterion, any such system should have records to show that it is consistently operational, well maintained, properly sized, and effectively removing bacteria in the treated effluent (in the case of disinfection facilities) so that it is effectively eliminating freshwater surface discharges to the surf zone during year-round dry weather days. If all dry weather creek flows tributary to the CML are known to be captured, infiltrated, diverted, or disinfected prior to discharging at the beach, reasonable assurance is assumed to be demonstrated.
5. Are there no anticipated non-stormwater MS4 outfall discharges within the CML's drainage area? For this criterion to be met, supporting records from the non-stormwater outfall screening program should be supplied.

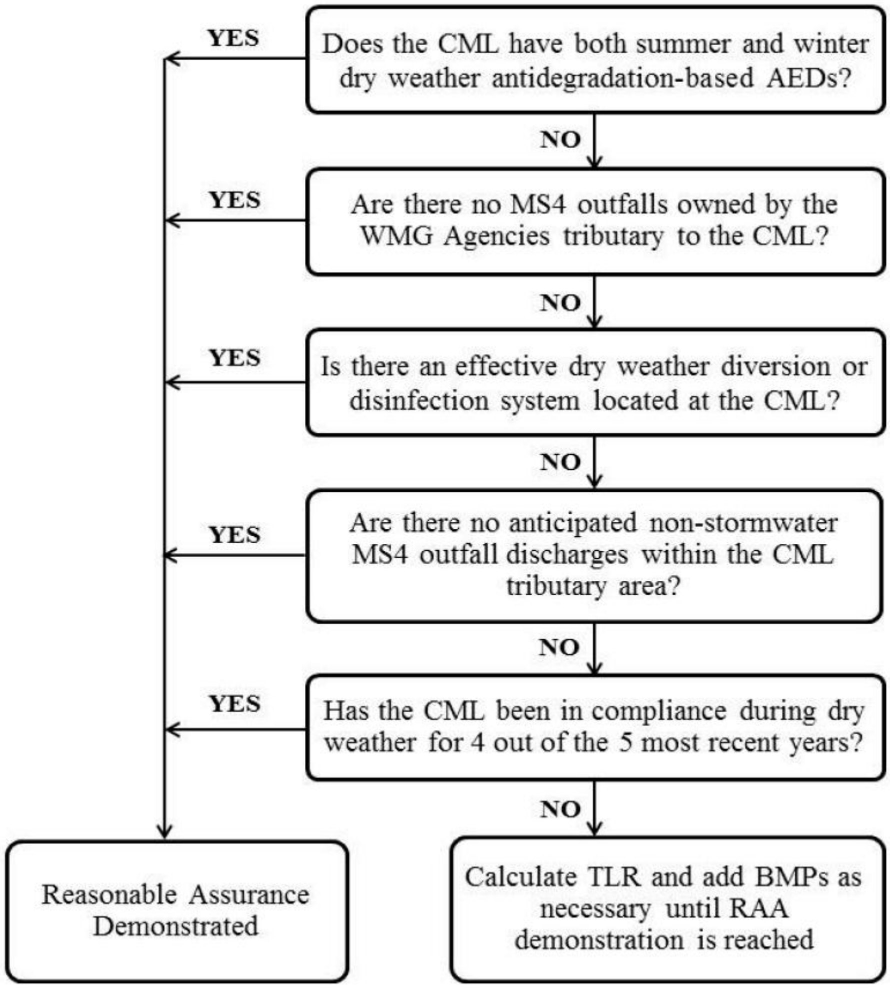

Figure 4-8 Dry Weather RAA Methodology Outline

For all CMLs which have not demonstrated reasonable assurance by the steps above, the total load reduction required to meet the applicable receiving water limit will be calculated based on historic monitoring data. This is accomplished by iteratively applying a reduction fraction to the historic dataset until the receiving water limit (in allowable exceedance days) is met during all years. This reduction fraction will then be compared with expected dry weather BMP load (or volume) reductions within the tributary watershed. If the calculated BMP load reduction exceeds the total required load reduction, then reasonable assurance has been demonstrated.

If the calculated BMP load reduction is less than the necessary load reduction, additional BMPs (non-structural and/or structural) will be iteratively implemented in the tributary watershed until reasonable assurance can be demonstrated (i.e., until the calculated BMP load reduction exceeds the total load reduction required). Where necessary and feasible, it may be assumed that structural BMPs (such as permeable street gutters and catch basin dry wells) will be implemented to a level to eliminate existing significant non-stormwater MS4 discharges (as defined in the CIMP).

4.5. Proposed Approach for RAA Output

4.5.1. Jurisdictional Responsibilities

This RAA approach was developed with an emphasis on encouraging collaborative, watershed-based planning within the Peninsula WMG members. Pollutant load reduction opportunities will be determined irrespective of jurisdictional boundaries. Once high priority areas and sources are identified, the Peninsula WMG agencies will identify the most feasible and effective BMPs to maximize pollutant removal and meet target load reduction requirements.

4.5.2. Example Output/Format

Table 4-6 and 4-7 illustrate examples of SBPAT output for the parameters modeled. This list will be limited to the identified Category/Priority 1, 2, and 3 water body-pollutant combinations identified in EWMP Work Plan Appendix A for the actual RAA.[71] This output will include non-structural and phased structural BMPs so that target load reductions can be expected to be met for the scheduled compliance dates. Ranges of results will also be reported (e.g., load with predicted ranges). Results may be broken down by jurisdiction at the discretion of the EWMP Group.

Table 4-6 Example SBPAT Output for Each Compliance Assessment Site.

Constituent	Units	Average Annual MS4 Loads and Volumes			% of MS4 Load Removed	
		Pre-BMP	w/ Dist. BMPs	w/ Dist. + Reg. BMPs	w/ Dist. BMPs	w/ Dist. + Reg. BMPs
Total runoff volume	Acre-ft	220	172	172	22%	22%
DCu	lbs	8.8	6.9	6.8	22%	23%
DP	lbs	170	125	118	27%	30%
DZn	lbs	163	73	63	55%	62%
FC	10^12 MPN	52.8	35.4	24.3	33%	54%
NH3	lbs	435	276	190	37%	56%
NO3	lbs	500	384	378	23%	25%
TCu	lbs	18.9	10.7	8.1	43%	57%
TKN	lbs	1645	1257	1194	24%	27%
TPb	lbs	7.63	4.18	3.54	45%	54%
TP	lbs	235	140	98	41%	58%
TSS	Tons	42	19	12	54%	71%
TZn	lbs	218	101	66	54%	70%

[71] If monitoring data collected as part of the CIMP demonstrate that additional water body-pollutant combinations should be identified due to MS4 contributions, the RAA will be updated accordingly to include these water body-pollutant combinations.

Table 4-7 Example Bacteria Output for Different TLRs Including Non-Structural BMPs

Subwatershed	Pollutant	Target Load Reduction	Sum of NS Load Reductions (low-high range)	Sum of Structural Load Reductions (low-high range)	Total Estimated Load Reductions (low-high range)
1	Fecal coliform	100	17 (12-20)	60 (40-85)	77 (52-105)
2	Fecal coliform	75	15 (11-19)	60 (40-85)	75 (51-104)

4.6. Conclusions

Multiple modeling approaches are described in the MS4 Permit. For the Peninsula EWMP, a modeling approach that utilizes SBPAT is proposed with the rationale, analytical basis, and process described herein. SBPAT meets MS4 Permit requirements and provides the informational submittal elements required by the Regional Board. It is also compatible with non-structural BMP analytical approaches and provides information with respect to variability that is important for the Peninsula WMG to establish reasonable assurance. A separate dry weather RAA methodology is also proposed to meet MS4 Permit requirements.

5. Next Steps and EWMP Development Schedule

This EWMP Work Plan lays the groundwork for the development of the Peninsula EWMP that will be submitted to the Regional Board on June 28, 2015. The Peninsula WMG will continue to move forward with EWMP development upon submittal of this Work Plan. In lieu of revising the Work Plan, the Peninsula WMG anticipates incorporating any potential comments received by the Regional Board and other stakeholders into the draft EWMP. The following sections summarize the major next steps and development schedule for the Peninsula EWMP.

5.1. Stakeholder Engagement

In addition to participating in the various Technical Advisory Committees and Subcommittees, the Peninsula WMG is actively soliciting stakeholder input on the Peninsula EWMP development. Key stakeholders have been identified and include:

- Key City Staff (e.g., Administrators, Stormwater Managers, Public Works)
- City Council Members and Water Quality and Flood Protection Oversight Committee
- Governmental Organizations (e.g., LA County Sanitation Districts, US EPA, Regional Water Quality Control Board, LA County Parks)
- Non-Governmental and Environmental Organizations (e.g., Palos Verdes Land Conservancy, Heal the Bay)

Two workshops (the first of which has already occurred) were planned to engage stakeholders in the Peninsula EWMP development process and solicit input. The first workshop was held on May 8, 2014 and presented an overview of the EWMP development process and the CIMP. Potential Watershed Control Measures were discussed and attendees were encouraged to provide feedback via email or a comment card that was distributed at the workshop. The next workshop is scheduled for late 2014/early 2015, and will cover the Peninsula EWMP development to-date, including proposed Watershed Control Measures for inclusion in the draft EWMP.

5.2. Schedule and Milestones

Table 5-1 summarizes the key milestones and schedule for development of the Peninsula EWMP.

Table 5-1 Peninsula EWMP Development Schedule and Milestones

Action Item/Deliverable	Milestone Target Date*
EWMP Work Plan and CIMP to Regional Board	June 28, 2014
Approach for Addressing Waterbody Pollutant Combinations Technical Memo	August 2014
Regional Project Initial Screening Technical Memo	August 2014
Watershed Control Measures Technical Memo (including Regional Project Feasibility and MCM Customization Recommendations)	December 2014
Results of RAA	January 2015
Implementation Schedule and Cost Estimates Technical Memo	February 2015
Draft EWMP	April 2015
Final Draft EWMP to Regional Board	June 28, 2015

*Milestone target dates are approximate and subject to change during EWMP development

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Appendix 1.A

Los Angeles County Flood Control District Summary

In 1915, the Los Angeles County Flood Control Act established the LACFCD and empowered it to manage flood risk and conserve stormwater for groundwater recharge. In coordination with the United States Army Corps of Engineers the LACFCD developed and constructed a comprehensive system that provides for the regulation and control of flood waters through the use of reservoirs and flood channels. The system also controls debris, collects surface storm water from streets, and replenishes groundwater with storm water and imported and recycled waters. The LACFCD covers the 2,753 square-mile portion of Los Angeles County south of the east-west projection of Avenue S, excluding Catalina Island. It is a special district governed by the County of Los Angeles Board of Supervisors, and its functions are carried out by the Los Angeles County Department of Public Works. The LACFCD service area is shown in **Figure 1.A -1.**

Unlike cities and counties, the LACFCD does not own or operate any municipal sanitary sewer systems, public streets, roads, or highways. The LACFCD operates and maintains storm drains and other appurtenant drainage infrastructure within its service area. The LACFCD has no planning, zoning, development permitting, or other land use authority within its service area. The permittees that have such land use authority are responsible under the Permit for inspecting and controlling pollutants from industrial and commercial facilities, development projects, and development construction sites. (Permit, Part II.E, p. 17.)

The MS4 Permit language clarifies the unique role of the LACFCD in storm water management programs: "[g]iven the LACFCD's limited land use authority, it is appropriate for the LACFCD to have a separate and uniquely-tailored storm water management program. Accordingly, the storm water management program minimum control measures imposed on the LACFCD in Part VI.D of this Order differ in some ways from the minimum control measures imposed on other Permittees. Namely, aside from its own properties and facilities, the LACFCD is not subject to the Industrial/Commercial Facilities Program, the Planning and Land Development Program, and the Development Construction Program. However, as a discharger of storm and non-storm water, the LACFCD remains subject to the Public Information and Participation Program and the Illicit Connections and Illicit Discharges Elimination Program. Further, as the owner and operator of certain properties, facilities and infrastructure, the LACFCD remains subject to requirements of a Public Agency Activities Program."
(Permit, Part II.F**,** p. 18.)

Consistent with the role and responsibilities of the LACFCD under the Permit, the EWMPs and CIMPs reflect the opportunities that are available for the LACFCD to collaborate with permittees having land use authority over the subject watershed area. In some instances, the opportunities are minimal, however the LACFCD remains responsible for compliance with certain aspects of the MS4 permit as discussed above.

In some instances, in recognition of the increased efficiency of implementing certain programs regionally, the LACFCD has committed to responsibilities above and beyond its obligations under the 2012 Permit. For example, although under the 2012 Permit the Public Information and

Participation Program is a responsibility of each Permittee, the LACFCD is committed to implementing certain regional elements of the PIPP on behalf of all Permittees at no cost to the Permittees. These regional elements include:

- Maintaining a countywide hotline (888-CLEAN-LA) and website (www.888cleanla.com) for public reporting and general stormwater management information at an estimated annual cost of $250,000. Each Permittee can utilize this hotline and website for public reporting within its jurisdiction.
- Broadcasting public service announcements and conducting regional advertising campaigns at an estimated annual cost of $750000.
- Facilitating the dissemination of public education and activity specific stormwater pollution prevention materials at an estimated annual cost of $100,000.
- Maintaining a stormwater website at an estimated annual cost of $10,000.

The LACFCD will implement these elements on behalf of all Permittees starting July 2015 and through the Permit term. With the LACFCD handling these elements regionally, Permittees can better focus on implementing local or watershed-specific programs, including student education and community events, to fully satisfy the PIPP requirements of the 2012 Permit.

Similarly, although water quality monitoring is a responsibility of each Permittee under the 2012 Permit, the LACFCD is committed to implement certain regional elements of the monitoring program. Specifically, the LACFCD will continue to conduct monitoring at the seven existing mass emissions stations required under the previous Permit. The LACFCD will also participate in the Southern California Stormwater Monitoring Coalition's Regional Bioassessment Program on behalf of all Permittees. By taking on these additional responsibilities, the LACFCD wishes to increase the efficiency and effectiveness of these programs.

Figure 1.A-1 Los Angeles County Flood Control District Service Area

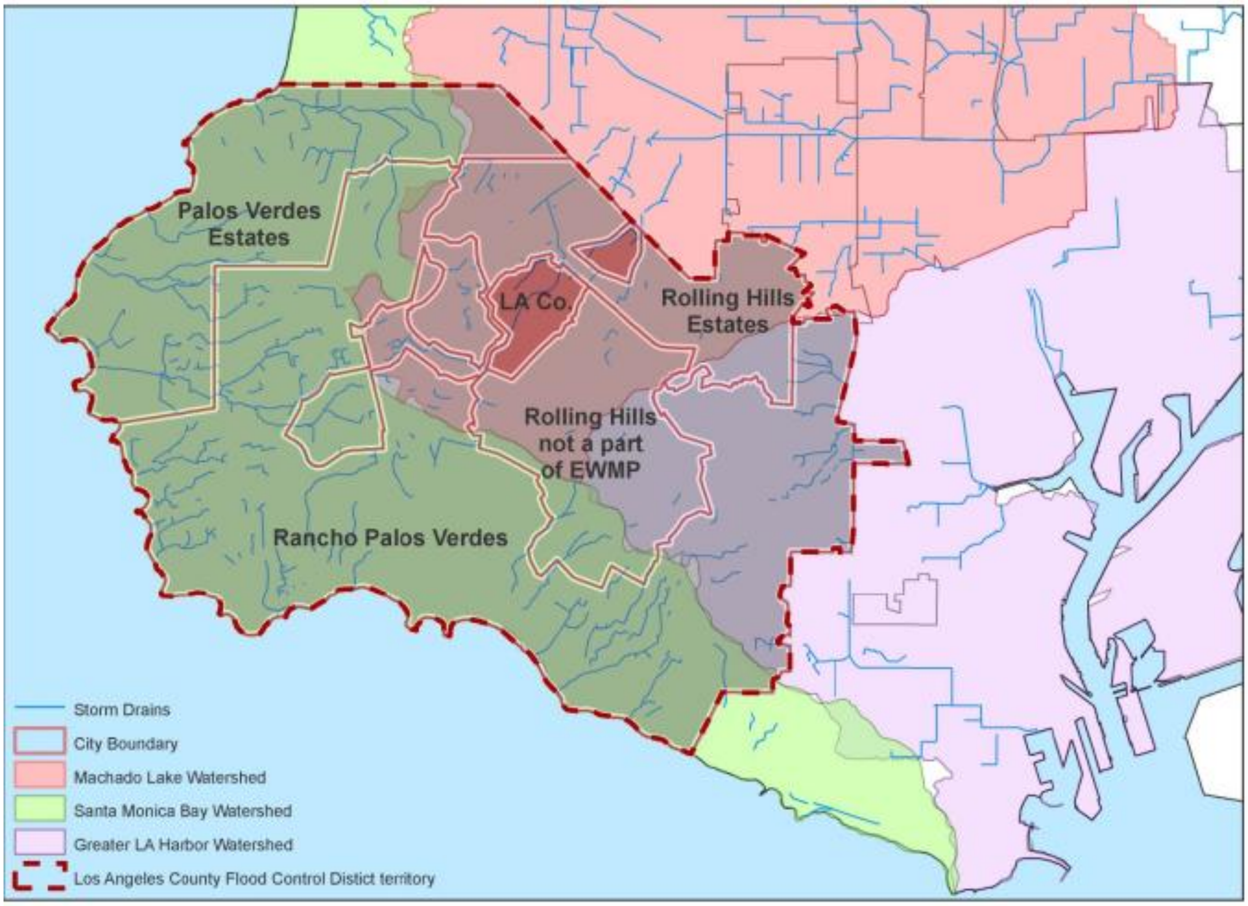

Figure 1.A-2 Los Angeles County Flood Control District Areas in Peninsula WMG

Appendix 3.A

BMP Performance Data

Performance Evaluation of Structural BMPs

It is important to take the performance of stormwater BMPs into consideration during the planning and implementation process. The statistical analysis presented herein has many applications, including supporting BMP prioritization and the RAA analysis. As future applications are undertaken, the results can be analyzed in more detail. This section provides an analysis of specific BMPs to determine the pollutant removal effectiveness of those BMPs. The International Stormwater BMP Database 1 (IBD) project website was used to analyze different BMP types for their effectiveness in removing specific pollutants. The website features a database of over 530 BMP studies, performance analysis results, BMP performance tools, monitoring guidance and other study-related publications.

Research on characterizing BMP performance suggests that effluent quality is more representative to stormwater treatment than percent removal, which assumes a linear influent-to-effluent relationship (Strecker et al. 2001). Schueler (1996) also found in his evaluation of detention basins and stormwater wetlands that BMP performance is often limited by an achievable effluent quality, or "irreducible pollutant concentration"; acknowledging that a practical lower limit exists at which stormwater pollutants can be removed by any given technology. While there is likely a relationship between influent and effluent water quality pertaining to specific BMPs and specific constituent concentrations, analyses conducted to date do not support fixed percent removal values relative to influent quality for the following reasons (WWE and Geosyntec, 2007):

1. Percent removal depends heavily on influent quality, and in the majority of cases, higher observed influent pollutant concentrations actually result in higher percent removals. In other words, observed effluent concentrations for most BMPs are relatively consistent; therefore, the use of a pre-set percent removal would under-predict BMP performance when influent concentrations are high and over-predict BMP performance when influent concentrations are low;
2. The variability in percent removal is often more broad than the variability in effluent pollutant concentration;
3. A high percent removal may still result in a high pollutant concentration, thereby leading to a false determination that BMPs are performing well; and
4. Different percent removals can be calculated within the same dataset (i.e., when looking at individual pairs of influent/effluent samples).

For the reasons stated above, percent removal is not used to quantify BMP performance. Instead raw effluent data has been used to estimate the "irreducible pollutant concentration" attributable to each BMP that will be analyzed as part of the RAA.

As with the estimation of land use event mean concentrations (EMCs), final effluent values used to predict BMP performance were determined from the data contained in the IBD using a combination of

[1] Geosyntec Consultants, Wright Water Engineers. International Stormwater Best Management Practices (BMP) Database Pollutant Category Summary Statistical Addendum: TSS, Bacteria, Nutrients, and Metals. July 2012.

regression-on-order statistics and the "bootstrap" method[2]. Log-normality was also assumed for BMP effluent concentrations. This assumption has been confirmed previously through goodness-of-fit tests on the BMP effluent concentration data (Geosyntec, 2008). Statistics for effluent concentrations based on available water quality performance data were developed for the BMPs and constituents listed in Table B-1 below. All constituents are addressed for all BMPs that provide treatment (i.e., excluding those identified as "volume reduction only"). Dissolved phosphorus and orthophosphate datasets were combined to provide a larger dataset and because the majority of orthophosphate is typically dissolved and many datasets either report dissolved phosphorus or orthophosphate, but not both.

Table B-1: BMPs and Constituents Analyzed.

BMPs	Constituents
• Constructed Wetland/Retention Pond (with Extended Detention) • Constructed Wetland/Retention Pond (without Extended Detention) • Dry Extended Detention Basin • Hydrodynamic Separator • Media Filter • Subsurface Flow Wetland • Treatment Plant • Bioswale • Bioretention with underdrain • Bioretention (volume reduction only) • Cistern (volume reduction only) • Green Roof (volume reduction only) • Porous Pavement (volume reduction only) • Low Flow Diversion (volume reduction only)	• Total suspended solids (TSS) • Total phosphorus (TP) • Dissolved phosphorus as P (DP)[b] • Ammonia as N (NH3) • Nitrate as N (NO3) • Total Kjeldahl nitrogen as N (TKN) • Dissolved copper (DCu) • Total copper (TCu) • Total lead (TPb) • Dissolved zinc (DZn) • Total zinc (TZn) • Fecal Coliform (FC)

Table B-2 summarizes the number of effluent data points (individual storm events) and percent non-detects for the pollutants and BMP types of interest for which sufficient data were available. A large percentage of non-detects can bias the effluent statistics derived from the dataset (e.g., total lead for bioretention shows a 60% non-detect ratio).

[2] The bootstrap approach randomly samples the dataset several thousand times and computes the desired statistic from the subset of data.

Table Table B-3 summarizes arithmetic averages and Table B-4 summarizes the arithmetic standard deviations of the BMP effluent concentrations that will be used in the RAA.

Consistent with IBD documentation (WWE and Geosyntec, 2007), BMP effluent concentrations are assumed to be limited by an "irreducible effluent concentration," or a minimum achievable concentration (Schuler, 1996). Lower limits are currently set at the 10th percentile effluent concentration of BMP data in the IBD for each modeled BMP type for which the BMP data show statistically significant reductions between influent and effluent means. If the differences are not statistically significant or there is a statistically significant increase, the 90th percentile is used as the minimum achievable effluent concentration, which essentially assumes no treatment except when influent to the BMP is very high. Table B-5 summarizes the irreducible effluent concentration estimates that are used in the RAA to prevent treatment from occurring when influent concentrations are equal to or below these values.

Table B-2: Summary of Number of Data Points and Percent Non-Detects for BMP Effluent Concentration Data from the International BMP Database

BMP		TSS	TP	DP	NH3	NO3	TKN	DCu	TCu	TPb	DZn	TZn	FC
Bioretention	Count	193	249	164	184	259	201	NA	39	48	15	48	29
	%ND	10%	5%	4%	18%	3%	2%	NA	18%	60%	0%	35%	0%
Vegetated Swales (Bioswales)	Count	354	364	249	225	372	324	82	309	308	72	373	92
	%ND	1%	1%	0%	17%	1%	0%	4%	3%	39%	6%	23%	0%
Hydrodynamic Separators (not updated - original SBPAT analysis, 2008)	Count	199	170	58	69	59	77	89	99	95	99	174	31
	%ND	7%	3%	33%	28%	3%	5%	17%	0%	8%	18%	7%	3.2%
Media Filters	Count	409	403	244	215	391	374	186	361	341	221	433	185
	%ND	7%	6%	14%	24%	2%	6%	7%	12%	21%	19%	13%	0%
Detention Basins	Count	299	275	116	94	213	185	170	198	209	163	189	190
	%ND	1%	3%	16%	6%	7%	4%	32%	31%	50%	17%	15%	0%
Retention Ponds	Count	723	654	618	423	626	496	213	536	646	212	593	137
	%ND	4%	3%	6%	8%	6%	3%	26%	21%	30%	15%	7%	0%
Wetland Basins/Retention Ponds (combined)	Count	1028	932	862	681	872	680	228	684	767	227	770	158
	%ND	4%	3%	6%	7%	7%	2%	25%	20%	28%	14%	8%	0%

Table B-3: International BMP Database Arithmetic Mean Estimates of BMP Effluent Concentrations

BMP	TSS mg/L	TP mg/L	DP mg/L	NH3 mg/L	NO3 mg/L	TKN mg/L	DCu ug/L	TCu ug/L	TPb ug/L	DZn ug/L	TZn ug/L	FC #/100 mL
Constructed Wetland / Retention Pond (with Extended Detention)[1]	38.3	0.19	0.11	0.18	0.42	1.20	5.3	6.7	7.2	22.1	35.3	1.01E+04
Constructed Wetland / Retention Pond (without Extended Detention)[2]	32.9	0.17	0.09	0.17	0.38	1.20	5.3	6.2	12.0	22.6	38.0	9.89E+03
Dry Extended Detention Basin[3]	42.3	0.37	0.26	0.16	0.61	2.40	6.5	11.4	14.4	33.7	78.4	1.41E+04
Hydrodynamic Separator[4]	98.1	0.50	0.06	0.30	0.67	2.07	13.1	16.7	12.7	78.4	107.4	2.68E+04
Media Filter[5]	22.3	0.14	0.07	0.18	0.74	0.98	8.3	11.0	4.6	34.7	37.6	5.89E+03
Sub-surface Flow Wetland[6]	18.1	0.06	0.06	0.09	0.27	0.87	4.6	4.6	0.7	20.9	25.8	PR=90%
Treatment Plant[7]	2.0	0.00	0.00	0.00	0.27	0.01	1.0	1.0	4.4	5.0	5.0	2.00E+00
Vegetated Swale (Bioswale)[8]	27.1	0.28	0.17	0.09	0.43	0.87	9.6	10.1	6.4	33.3	33.3	8.00E+04
Bioretention[9]	18.1	0.14	0.07	0.18	0.37	0.98	8.3	8.8	4.2	34.7	37.6	5.89E+03
Bioretention w/o underdrain	Volume reductions only											
Cistern	Volume reductions only											
Green Roof	Volume reductions only											
Porous Pavement	Volume reductions only											
Infiltration Basin	Volume reductions only											

[1] Based on retention pond IBD category (basis per Geosyntec 2008)
[2] Based on combined wetland basin and retention pond IBD categories (basis per Geosyntec 2008)
[3] Strictly detention basin category from the IBD
[4] From Geosyntec, 2008
[5] Includes non-bio media filters (e.g., sand filters)
[6] Lowest of all IBD categories; except for Fecal Coliform where 90% removal is used. The 90% removal is based on USEPA, 1993, which states that SSF wetlands are generally capable of a 1 to 2 log reduction in fecal coliforms.
[7] Secondary Drinking Water Standards or Minimum of all BMP types, whichever is less
[8] Strictly from vegetated swale category from the IBD
[9] Effluent quality assigned to treated underdrain discharge is based on the better performing characteristics of the “media filter” and “bioretention” categories for each pollutant.

Table B-4: International BMP Database Arithmetic Standard Deviations of BMP Effluent Concentrations

BMP	TSS mg/L	TP mg/L	DP mg/L	NH3 mg/L	NO3 mg/L	TKN mg/L	DCu ug/L	TCu ug/L	TPb ug/L	DZn ug/L	TZn ug/L	FC #/100 mL
Constructed Wetland / Wetpond (with Extended Detention)	76.80	0.253	0.357	0.234	0.787	0.688	4.288	9.710	12.96	42.46	61.96	3.23E+04
Constructed Wetland / Wetpond (without Extended Detention)	71.14	0.228	0.313	0.375	0.750	0.848	4.196	8.849	123.0	41.88	85.57	3.08E+04
Dry Extended Detention Basin	87.36	0.673	0.439	0.183	1.173	5.029	6.656	19.96	56.01	64.68	137.9	4.15E+04
Hydrodynamic Separator	236.5	1.237	0.093	0.880	1.198	3.737	11.98	11.98	25.70	137.4	137.4	2.16E+05
Media Filter	40.73	0.168	0.099	0.382	0.852	1.213	13.75	17.20	10.02	142.2	100.3	1.27E+04
Sub-surface Flow Wetland	30.66	0.145	0.088	0.145	0.552	0.594	3.504	3.504	1.845	12.84	17.16	5.37E+02
Treatment Plant	2.00	0.003	0.003	0.006	0.552	0.030	3.000	3.000	10.97	15.00	15.00	1.00E+00
Vegetated Swale (Bioswale)	35.12	0.311	0.239	0.145	0.905	0.872	7.749	9.429	15.36	28.49	34.86	1.19E+06
Bioretention	30.66	0.168	0.099	0.382	0.552	1.213	13.75	11.12	4.84	100.3	100.3	1.27E+04
Bioretention w/o underdrain	Volume reductions only											
Cistern	Volume reductions only											
Green Roof	Volume reductions only											
Porous Pavement	Volume reductions only											
Infiltration Basin	Volume reductions only											

Table B-5: International BMP Database Arithmetic Irreducible of BMP Effluent Concentrations

BMP	TSS mg/L	TP mg/L	DP mg/L	NH3 mg/L	NO3 mg/L	TKN mg/L	DCu ug/L	TCu ug/L	TPb ug/L	DZn ug/L	TZn ug/L	FC #/100 mL
Constructed Wetland / Wetpond (with Extended Detention)	1.358	0.034	0.010	0.019	0.011	0.499	1.387	1.387	0.429	1.000	2.933	4
Constructed Wetland / Wetpond (without Extended Detention)	1.300	0.030	0.009	0.012	0.010	0.520	1.267	1.267	0.400	1.075	3.000	5.4
Dry Extended Detention Basin	5.460	0.089	0.523	0.336	0.026	3.650	1.153	1.274	0.435	8.396	8.396	19.6
Hydrodynamic Separator	5.543	0.023	0.172	0.014	1.299	3.576	3.340	3.340	1.351	17.793	17.793	3295
Media Filter	1.487	0.026	0.010	0.013	0.064	0.210	0.995	1.298	0.372	1.000	2.000	13.1
Sub-surface Flow Wetland	1.268	0.025	0.006	0.009	0.008	0.141	1.000	1.000	0.089	1.000	2.933	4
Treatment Plant	0.500	0.001	0.001	0.001	0.008	0.001	0.100	0.100	0.255	0.500	0.500	1
Vegetated Swale (Bioswale)	2.000	0.079	0.040	0.009	0.056	0.141	2.708	2.708	0.434	5.720	5.720	9.53E+04
Bioretention	1.605	0.026	0.010	0.013	0.050	0.210	0.995	1.524	0.836	1.000	2.000	13.1
Bioretention w/o underdrain	Volume reductions only											
Cistern	Volume reductions only											
Green Roof	Volume reductions only											
Porous Pavement	Volume reductions only											
Infiltration Basin	Volume reductions only											

In some cases, performance data are not available for all types of BMPs requiring a performance assessment as part of the RAA. If the unit treatment processes (e.g., filtration, sedimentation, etc.) for a BMP with data ("BMP 1") can be expected to be similar for a BMP without data ("BMP 2"), then equivalent performance for "BMP 2" is assumed based on the performance of "BMP 1". However if no data exist and unit treatment processes cannot be associated with a BMP with data, then no treatment is assumed except for load reductions associated with simulated volume loss. Table B-6 summarizes the performance assumptions for each of the BMPs that will be modeled in the RAA. Additionally, bioretention with underdrains will be assessed in the RAA using a vegetated swale BMP from the IBD, which represents some incidental volume reduction as well as a certain percent treated discharge and a certain percent bypass discharge. These inputs will be modified to match the proposed implementation. Effluent quality assigned to treated underdrain discharge will be based on the better performing characteristics of the "media filter" and "bioretention" categories for each pollutant.

Table B-6: Major Assumptions and Source Data for BMP Performance

BMP Name	Source/Analysis Assumptions
Vegetated Swale (Bioswale)	Strictly from vegetated swale category from the IBD
Cistern	No treated effluent; volume reductions only
Bioretention w/o underdrain	No treated effluent; volume reductions only
Porous Pavement	No treated effluent; volume reductions only
Green Roof	No treated effluent; volume reductions only
Low Flow Diversion	No treated effluent; volume reductions only
Media Filter	Strictly from media filter category from the IBD; includes non-bio media filters (e.g., sand filters)
Subsurface Flow Wetland	Lowest of all IBD categories; except for Fecal Coliform where 90% removal is used[a].
Constructed Wetland / Retention Pond (w/o Extended Detention)	Based on combined wetland basin and retention pond IBD categories (basis per Geosyntec 2008)
Treatment Plant	Secondary Drinking Water Standards or Minimum of all BMP types, whichever is less
Dry Extended Detention Basin	Strictly detention basin category from the IBD
Hydrodynamic Separator	From Geosyntec, 2008
Infiltration Basin	No treated effluent; volume reductions only
Constructed Wetland / Retention Pond (w/ Extended Detention)	Based on retention pond IBD category (basis per Geosyntec 2008)

[a] SSF wetlands provide multiple unit treatment processes provided by other BMPs (e.g., sedimentation, filtration, biochemical, etc.). The 90% removal is based on USEPA, 1993, which states that SSF wetlands are generally capable of a 1 to 2 log reduction in fecal coliforms.

Appendix 3.B

Existing and Planned Control Measures

Existing and Planned Distributed BMPs

	No.	Source	Name	BMP Category	Location (Address or Lat/Long)	Description	Treatment Volume	Drainage Area	Existing or Proposed
Rancho Palos Verdes	1	DR	108 Rocking Horse Road	Vegetated Swales	33.758831,-118.3186264			7,582	Existing
	2	DR	11 Clipper Road	Filtration Device	33.7440834,-118.3857803	Golf Green & Inline Filter 295 GPM	295 GPM	9,100	Existing
	3	DR	28220 HighRidge Road	Bioretention with Underdrain	33.77528,-118.3811569	MWS Linear - Vault type		40,805	
	4	DR	29421 S. Western	Filtration Device	33.7504082,-118.3095856	Flo-Gard Plus / Unknown Size			Existing
	5	DR	29941 Hawthorne Blvd	Bioretention with Underdrain	33.76144,-118.393639	Modular Wetland System		23,087	Existing
	6	DR		Permeable Pavers	33.7574814,-118.4122384			3,610	Existing
	7	DR	30504 Palos Verdes Drive	Bioretention without Underdrain				9,740	
	8	DR		Dry Extended Detention Basin		Non-proprietary 3,693 cf capacity	3,693 cu. ft.	23,087	Existing
	9	DR		Bioretention with Underdrain		8x12 Filterra Biofilter	0.224 cfs	34,978	Proposed
	10	DR		Bioretention with Underdrain		8x12 Filterra Biofilter	0.224 cfs	19,427	Existing
	11	DR		Bioretention with Underdrain	33.7343178,-118.3336182	8x12 Filterra Biofilter	0.224 cfs	47,632	Existing
	12	DR		Filtration Device		KriStar FloGard +Plus Model FGP-42CL	1.5 cfs	34,978	Proposed
	13	DR		Filtration Device		KriStar FloGard +Plus Model FGP-42CL	1.5 cfs	19,427	Existing
	14	DR		Filtration Device		KriStar FloGard +Plus Model FGP-42CL	1.5 cfs	47,632	Existing
	15	DR	30800 Palos Verdes Drive East	Filtration Device		KriStar FloGard +Plus Model FGP-24F	1.5 cfs	13,068	Existing
	16	DR		Filtration Device		Kristar Flogard 24F		6,098	Existing
	17	DR		Filtration Device	33.744091,-118.3985443	Kristar CB Filter12F		10,454	Existing
	18	DR	30840 Hawthorne Blvd.	Bioretention with Underdrain		Filterra 6.5'X4'		10,454	Existing
	19	DR		Bioretention with Underdrain		Modular Wetland System		210,830	Existing
	20	DR		Bioretention with Underdrain	33.7495306,-118.4066179	Filterra		8,712	Existing
	21	DR		Vegetated Swales		Vegetated Swale		10,890	Existing
	22	DR	31176 Hawthorne Blvd	Filtration Device		Kristar Flogard FGM1818		10,890	Existing
	23	DR	31186 Hawthorne Blvd	Filtration Device	33.7491684,-118.4071045	(3) Abtech Ultra Urban Filter DI2020, (3) Kristar Drain Flo-Gard Filter		23,600	Existing
	24	DR		Filtration Device		Contech CSD2015		35,066	
	25	DR		Dry Extended Detention Basin		Contech Chamber Max		35,066	
	26	DR		Permable Pavers	33.7488057,-118.4073186			1,829	
	27	DR		Vegetated Swale				9,699	
	28	DR	31270 Palos Verdes Drive	Filtration Device		Kristar Flo-Gard GF-M2424		6,403	
	29	DR	3231 Palos Verdes Dr. South	Filtration Device	33.7302628,-118.3374634	Flo-gard Plus Filter Insert FGP-16F			Existing
	30	DR		Bioretention with Underdrain		8' x 16' Filterra		202,251	
	31	DR		Bioretention with Underdrain	33.763122,-118.3687934	8' x 12' Filterra		97,357	
	32	DR	5448 Crest Road	Filtration Device		Flo-Gard TD Filter FG-TD0F6		46,827	
	33	DR	5448 Crest Road	Bioretention with Underdrain	33.763122,-118.3687934	22' x 5' Modular Wetlands Systems		229,608	
	34	DR		Catch Basin Insert		Suntree Model GISB 18"x18" x12"		18,731	
	35	DR		Biofiltration		Modular Wetlands Systems Vertical Type Bio-Filter	0.0555 cfs	13,068	
	36	DR		Catch Basin Insert	33.7680435,-118.3717957	Suntree Model GISB 24"x24"x12"		218	
	37	DR		Biofiltration		Modular Wetlands System Linear Type Bio-Filter	0.15 cfs	47,916	
	38	DR		Catch Basin Filter		Suntree Model GISB 36"x36"x9"		16,988	
	39	DR	5555 Crestridge Road	Filtration Device		Bio-Clean Under Sidewalk Drain		60,984	
	40	DR	5640 W. Crestridge Road	Filtration Device	33.7553101,-118.3630829	Carson 24" Capture Flow Filter		31,720	Existing
	41	DR	5701 Crestridge Road	Filtration Device	33.7684784,-118.3756561	FGP 1836-W			Existing
	42	DR		Vegetated Swale		Non-Proprietary TC-31		17,248	Proposed
	43	DR		Vegetated Swale		Non-Proprietary TC-31		278,228	Proposed
	44	DR		Vegetated Swale		Non-Proprietary TC-31		58,893	Proposed
	45	DR		Vegetated Swale	33.7444156,-118.3813796	Non-Proprietary TC-31		151,468	Proposed
	46	DR		Filtration Device		Kristar MP-52 Drain Insert Model #FG-TDOF6		4,300	Proposed
	47	DR	6001 Palos Verdes Drive South	Filtration Device		Kristar MP-52 Drain Insert Model #FG-TDOF6		20,228	Proposed
	48	DR		Wet Detention Basin		Wet Pond			Existing
	49	DR		Filtration Device	33.7429719,-118.3963671	Storm Filter			Existing
	50	DR		Filtration Device		Fossil Filter			Existing
	51	DR	6610 Palos Verdes Drive South	Vegetated Swale		Bioswale			Existing

Rancho Palos Verdes	52	DR		Filtration Device	33.7441788,-118.3841476	Kristar Flo-Gard Lo Pro Filter FG-1818	10,090	
	53	DR	7 Sea Cove Drive	Filtration Device		Kristar Flo-Gard Lo Pro Filter FG-TDOA-6		
	54	DR	Larchbluff Dr.	Catch Basin Insert	33.7763172,-118.3669279	CPS		Existing
	55	DR	Larchbluff Dr.	Catch Basin Insert	33.7763172,-118.3669279	CPS		Existing
	56	DR	Elmbridge Dr	Catch Basin Insert	33.7768602,-118.366016	CPS		Existing
	57	DR	Elmbridge Dr	Catch Basin Insert	33.7768602,-118.366016	CPS		Existing
	58	DR	Longhill Dr	Catch Basin Insert	33.7732299,-118.3659402	CPS		Existing
	59	DR	Longhill Dr	Catch Basin Insert	33.7732299,-118.3659402	CPS		Existing
	60	DR	Golden Arrow Dr.	Catch Basin Insert	33.7712925,-118.3642124	CPS		Existing
	61	DR	Golden Arrow Dr.	Catch Basin Insert	33.7712925,-118.3642124	CPS		Existing
	62	DR	Silver Arrow Dr	Catch Basin Insert	33.7767497,-118.3721099	CPS		Existing
	63	DR	Silver Arrow Dr.	Catch Basin Insert	33.7767497,-118.3721099	CPS		Existing
	64	DR	Graylog	Catch Basin Insert	33.7920227,-118.3732605	CPS		Existing
	65	DR	Bayridge Rd	Catch Basin Insert	33.791965,-118.372673	CPS		Existing
	66	DR	Bayridge Rd	Catch Basin Insert	33.791965,-118.372673	CPS		Existing
	67	DR	Bayridge Rd	Catch Basin Insert	33.79248,-118.370193	CPS		Existing
	68	DR	Birchfield Ave	Catch Basin Insert	33.7902557,-118.3725553	CPS		Existing
	69	DR	Birchfield Ave	Catch Basin Insert	33.7902557,-118.3725553	CPS		Existing
	70	DR	Ironwood	Catch Basin Insert	33.7881001,-118.3737199	CPS		Existing
	71	DR	Ironwood	Catch Basin Insert	33.7881001,-118.3737199	CPS		Existing
	72	DR	Silver Spur Rd	Catch Basin Insert	33.7904968,-118.3699493	CPS		Existing
	73	DR	Montemalaga	Catch Basin Insert	33.787205,-118.374306	CPS		Existing
	74	DR	Montemalaga Dr	Catch Basin Insert	33.7872047,-118.3743057	CPS		Existing
	75	DR	Whitefox Dr	Catch Basin Insert	33.7869568,-118.374115	CPS		Existing
	76	DR	Whitefox Dr.	Catch Basin Insert	33.7869568,-118.374115	CPS		Existing
	77	DR	Shadowwood Dr	Catch Basin Insert	33.782932,-118.371124	CPS		Existing
	78	DR	Shadow Wood Dr	Catch Basin Insert	33.782932,-118.371124	CPS		Existing
	79	DR	Whitehorn Dr.	Catch Basin Insert	33.7846858,-118.3709371	CPS		Existing
	80	DR	Whitehorn Dr.	Catch Basin Insert	33.7846858,-118.3709371	CPS		Existing
	81	DR	Silver Spur Rd	Catch Basin Insert	33.7778997,-118.3745769	CPS		Existing
	82	DR	Silver Spur Rd	Catch Basin Insert	33.7778997,-118.3745769	CPS		Existing
	83	DR	Ravenspur rd	Catch Basin Insert	33.7770348,-118.3808289	CPS		Existing
	84	DR	Silver Spur Rd	Catch Basin Insert	33.773643,-118.373436	CPS		Existing
	85	DR	Middlecrest	Catch Basin Insert	33.7661514,-118.3667374	CPS		Existing
	86	DR	Middlecrest	Catch Basin Insert	33.7661514,-118.3667374	CPS		Existing
	87	DR	Crestridge	Catch Basin Insert	33.7671802,-118.3718303	CPS		Existing
	88	DR	Crestridge	Catch Basin Insert	33.7671802,-118.3718303	CPS		Existing
	89	DR	Crestridge	Catch Basin Insert	33.7671802,-118.3718303	CPS		Existing
	90	DR	Crestridge	Catch Basin Insert	33.7671802,-118.3718303	CPS		Existing
	91	DR	Crest Rd	Catch Basin Insert	33.7631442,-118.3691387	CPS		Existing
	92	DR	Hawthorne Blvd	Catch Basin Insert	33.776891, -118.373477	CPS		Existing
	93	DR	Hawthorne Blvd	Catch Basin Insert	33.778148, -118.371514	CPS		Existing
	94	DR	Hawthorne Blvd	Catch Basin Insert	33.779646, -118.370173	CPS		Existing
	95	DR	Hawthorne Blvd.	Catch Basin Insert	33.781100, -118.369636	CPS		Existing
	96	DR	Hawthorne Blvd	Catch Basin Insert	33.784881, -118.367040	CPS		Existing
	97	DR	Hawthorne Blvd	Catch Basin Insert	33.785514, -118.365709	CPS		Existing
	98	DR	Hawthorne Blvd.	Catch Basin Insert	33.785603, -118.366074	CPS		Existing
	99	DR	Hawthorne blvd	Catch Basin Insert	33.785121, -118.367126	CPS		Existing
	100	DR	Hawthorne Blvd	Catch Basin Insert	33.781412, -118.369872	CPS		Existing
	101	DR	Hawthorne Blvd.	Catch Basin Insert	33.779780, -118.370462	CPS		Existing
	102	DR	Hawthorne Blvd.	Catch Basin Insert	33.778745, -118.371256	CPS		Existing
	103	DR	Hawthorne Blvd.	Catch Basin Insert	33.777675, -118.372479	CPS		Existing
	104	DR	Hawthorne Blvd	Catch Basin Insert	33.776926, -118.378208	CPS		Existing
	105	DR	Hawthorne Blvd	Catch Basin Insert	33.777488, -118.372254	CPS		Existing
	106	DR	Hawthorne Blvd	Catch Basin Insert	33.780689, -118.369743	CPS		Existing
	107	DR	Hawthorne Blvd.	Catch Basin Insert	33.782518, -118.369400	CPS		Existing
	108	DR	Hawthorne Blvd.	Catch Basin Insert	33.784702, -118.367297	CPS		Existing
	109	DR	Hawthorne Blvd	Catch Basin Insert	33.785603, -118.365860	CPS		Existing
	110	DR	Hawthorne Blvd	Catch Basin Insert	33.784765, -118.367716	CPS		Existing
	111	DR	Hawthorne Blvd	Catch Basin Insert	33.784515, -118.368080	CPS		Existing
	112	DR	Hawthorne Blvd.	Catch Basin Insert	33.783588, -118.368810	CPS		Existing
	113	DR	Hawthorne Blvd.	Catch Basin Insert	33.782509, -118.369658	CPS		Existing
	114	DR	Hawthorne Blvd.	Catch Basin Insert	33.777626, -118.372499	CPS		Existing
	115	DR	Crenshaw	Catch Basin Insert	33.765453, -118.371630	CPS		Existing
	116	DR	Crenshaw	Catch Basin Insert	33.765292, -118.371523	CPS		Existing
	117	DR	Crenshaw	Catch Basin Insert	33.766469, -118.371845	CPS		Existing
	118	DR	Unknown	Catch Basin Insert	Unknown	CPS		Existing
	119	DR	Unknown	Catch Basin Insert	Unknown	CPS		Existing
	120	DR	Unknown	Catch Basin Insert	Unknown	CPS		Existing
	121	DR	Unknown	Catch Basin Insert	Unknown	CPS		Existing

LA County	122	DR	Silver Spur Rd/RHE	Bioretention with Underdrain	-118.367190	33.770447	Rain Garden	Existing
	123	DR	Sunnyridge Rd/LA Co	Bioretention with Underdrain	-118.362232	33.769477	Planter Box	Existing
	124	DR	Golden Spar Pl/RHE	Other	-118.363704	33.782673	Other	Existing
	125	DR	Wildhorse Ln/RHE	Source Control	-118.357133	33.790969	Landscaping and Irrigation	Existing
	126	DR	Westvale Rd/LA Co	Capture and Reuse	-118.352831	33.777977	Rain Barrel	Existing
	127	DR	Eastvale Rd/LA Co	Source Control	-118.351640	33.775419	Landscaping and Irrigation	Existing
	128	DR	Eastvale Rd/LA Co	Source Control	-118.351174	33.776800	Disconnect Impervious Surface	Existing
	129	DR	Dapplegray Ln/RHE	Capture and Reuse	-118.326871	33.776671	Rain Barrel	Existing
	130	DR	Palos Verdes Drive N/RHE	Bioretention with Underdrain	-118.319075	33.774131	Planter Box	Existing
	131	DR	Spinning Wheel Ln/RHE	Bioretention with Underdrain	-118.322039	33.770133	Rain Barrel	Existing
	132	DR	Rolling Hills Villas LLC/RHE	Other	-118.365721	33.768761	Mixed Use Development (Comm/Res) Stormwater C	Existing

Rolling Hills Estates	133	DR		Infiltration Trench					Existing
	134	DR		Infiltration Trench					Existing
	135	DR		Permable Pavers	33.7746019,-118.3748585				Existing
	136	DR		Filtration Device		Flo-Gard Filter FGP-12F			Existing
	137	DR		Filtration Device		Flo-Gard Filter FGP-12F			Existing
	138	DR	Silver Center/449 Silver Spur Rd	Filtration Device		Flo-Gard Filter FF-12D			Existing
	139	DR	Peppertree Project	Permable Pavers	33.761300, -118.391958	34 Geo Block Porous Pavement			Existing
	140	DR	Ernie Howlett Park	Permable Pavers	33.7894808,-118.3560462	Gravel Paved Surface			Existing
	141	DR		Permable Pavers		Gravel Paved Surface			Existing
	142	DR	Rolling Hills Estates Municipal Stables	Diversion Line	33.7844201,-118.3501822	Diversion line to sanitary sewer equipped with 2-stage pretreatment			Existing
	143	DR		Infiltration Basin	33.7683707,-118.3806594				Existing
	144	DR	Highridge Park	Permable Pavers		Gravel Paved Surface			Existing
	145	DR	Empty Saddle Club	Permable Pavers	33.7819214,-118.3367233	Gravel Paved Surface			Existing
	146	DR	981 Silver Spur	Filtration Device	33.7690075,-118.3645823	In-line filters on parking area drains			Existing
	147	DR	Silver Spur Vegetated Swale/Spur Road	Vegtated Swale	33.7766102,-118.3749202	Drought tolerant vegetated swales			Existing
	148	DR	between Hawthorne Boulevard and Palos	Vegetated Swale					Existing
	149	DR	Palos Verdes Drive N Vegetated Swale/Center median of Palos Verdes Drive North from the intersection at Palos Verdes Drive East to the municipal boundary with the City of Lomita	Vegetated Swale	33.7728001,-118.3266699				Existing
	150	DR	Palos Verdes Dr North N/S	Catch Basin Insert		CPS Device			Existing
	151	DR	Silver Spur Rd E/S 200-300' N Of Montemalaga E Side	Catch Basin Insert	33.7873001,-118.3722098	CPS Device			Existing
	152	DR	Indian Peak Rd 200' South Of Hawthorne W Side	Catch Basin Insert	33.7768,-118.3783199	CPS Device			Existing
	153	DR	Indian Peak Rd 200' South Of Hawthorne E Side	Catch Basin Insert	33.7768,-118.3783199	CPS Device			Existing
	154	DR	810 Silver Spur Rd	Catch Basin Insert	33.7708702,-118.3674164	CPS Device			Existing
	155	DR	3717 Palos Verdes Dr	Catch Basin Insert	33.7793922,-118.3470688	CPS Device			Existing
	156	DR	Hawthorne Blvd. & Palos Verdes Dr.	Catch Basin Insert	33.7879298,-118.35809	CPS Device			Existing
	157	DR	Palos Verdes Dr. & Strawberry Ln	Catch Basin Insert	33.7721799,-118.3346897	CPS Device			Existing
	158	DR	Palos Verdes Dr. & Strawberry Ln	Catch Basin Insert	33.7721799,-118.3346897	CPS Device			Existing
	159	DR	Silver Spur Rd & Crenshaw Blvd	Catch Basin Insert	33.76875,-118.3639902	CPS Device			Existing
	160	DR	Portuguese Bend Rd & Blackwater Cyn. Rd.	Catch Basin Insert	33.7835884,-118.3538818	CPS Device			Existing
	161	DR	Indian Peak Rd & Crossfield	Catch Basin Insert	33.7722,-118.37603	CPS Device			Existing
	162	DR	Indian Peak Rd & Crossfield	Catch Basin Insert	33.7722,-118.37603	CPS Device			Existing
	163	DR	Indian Peak Rd & Crossfield	Catch Basin Insert	33.7722,-118.37603	CPS Device			Existing
	164	DR	Deep Valley Dr & Drybank Dr	Catch Basin Insert	33.77128,-118.37258	CPS Device			Existing
	165	DR	Drybank Dr & Silver Spur Rd	Catch Basin Insert	33.7721101,-118.3718102	CPS Device			Existing
	166	DR	Silver Spur Rd & Drybank Dr	Catch Basin Insert	33.7721101,-118.3718102	CPS Device			Existing
	167	DR	Roxcove Dr & Silver Spur Dr	Catch Basin Insert	33.7704398,-118.3683602	CPS Device			Existing
	168	DR	Roxcove Dr & Silver Spur Dr	Catch Basin Insert	33.7704398,-118.3683602	CPS Device			Existing
	169	DR	810 Silver Spur Rd	Catch Basin Insert	33.7708702,-118.3674164	CPS Device			Existing
	170	DR	810 Silver Spur Rd	Catch Basin Insert	33.7708702,-118.3674164	CPS Device			Existing
	171	DR	Silver Spur Rd & Beechgate Dr	Catch Basin Insert	33.77083,-118.36649	CPS Device			Existing
	172	DR	Beechgate Dr & Silver Spur Dr	Catch Basin Insert	33.77083,-118.36649	CPS Device			Existing
	173	DR	Marina Dr & Silver Spur Rd	Catch Basin Insert	33.7910901,-118.3631098	CPS Device			Existing
	174	DR	Crenshaw Blvd & Palos Verdes Dr N	Catch Basin Insert	33.7825097,-118.3523702	CPS Device			Existing
	175	DR	Palos Verdes Dr N & Crenshaw Blvd	Catch Basin Insert	33.7825097,-118.3523702	CPS Device			Existing
	176	DR	Palos Verdes Dr N & Crenshaw Blvd	Catch Basin Insert	33.7825097,-118.3523702	CPS Device			Existing
	177	DR	Crenshaw Blvd & Palos Verdes Dr N	Catch Basin Insert	33.7825097,-118.3523702	CPS Device			Existing
	178	DR	Deep Valley Dr & Silver Spur Rd	Catch Basin Insert	33.7696599,-118.3651898	CPS Device			Existing
	179	DR	Silver Spur Rd & Crenshaw Blvd	Catch Basin Insert	33.76875,-118.3639902	CPS Device			Existing
	180	DR	Deep Valley Dr & Silver Spur Rd	Catch Basin Insert	33.7696599,-118.3651898	CPS Device			Existing
	181	DR	27177 Crenshaw	Catch Basin Insert	33.786869,-118.3430023	CPS Device			Existing
	182	DR	Model Equestrian Center	Source Control/Filtration	33.7844201,-118.3501822	Biofiltration	24,000 cf	9 acres	Planned

Planned Distributed BMPs

	Source	Name	BMP Category	Location (Address or Lat/Long)	Description	Existing or Planned
Rancho Palos Verdes	DR	Machado Lake Catch Basin Connector Pipe Screens	Filtration Device	Various	40 CPS units are scheduled to be installed in 2013-14 in catch basins draining to Machado Lake	Planned
Rancho Palos Verdes	DR	Santa Monica Bay Full Capture Catch Basin Inserts	Filtration Device	Various	60% of catch basins in City draining to SMB will be retrofitted with full capture trash devices within the permit term (before 2017)	Planned
Palos Verdes Estates	DR	Machado Lake Catch Basin Full Capture Inserts	Filtration Device	Various	26 full capture units are scheduled to be installed in catch basins draining to Machado Lake within the permit term (before 2017)	Planned
Palos Verdes Estates	DR	Santa Monica Bay Full Capture Catch Basin Inserts	Filtration Device	Various	41% of catch basins in City draining to SMB will be retrofitted with full capture trash devices within the permit term (before 2017)	Planned
Rolling Hills Estates	DR	Machado Lake Catch Basin Full Capture Inserts	Filtration Device	Various	Full capture units are scheduled to be installed in 100% of the catch basins draining to Machado Lake (that have not already been retrofitted) within the permit term (before 2017)	Planned
Rolling Hills Estates	DR	Santa Monica Bay Full Capture Catch Basin Inserts	Filtration Device	Various	61% of catch basins in City draining to SMB will be retrofitted with full capture trash devices within the permit term (before 2017)	Planned

Existing and Planned Regional BMPs in the Peninsula EWMP Area

	No.	Name	Source	BMP Category	Lat/Long	Description	Existing/Planned/Potential	Treatment Volume	Drainage Area
Rolling Hills Estates	R1	Chandler Quarry Project	Project EIR	Retention, Infiltration, Detention	33.780257, -118.326528	The project site lies within the Machado Lake sub-watershed of the Dominguez Watershed Management Area (DWMA) in the Los Angeles Basin. The 226-acre project site currently consists of the Chandler's facility, the Rolling Hills Country Club, and surrounding undeveloped land. The proposed project consists of redeveloping/reusing the existing Chandler's facility and the adjacent Rolling Hills Country Club into a new residential community, reconfigured 18-hole golf course and club house, and natural open space set aside. The project includes 3 proposed wet retention ponds in the form of water features on the golf course	Planned	12.7 acre feet	707 acres
	R2	Butcher Ranch	Project Hydro Calcs	Bioretention w/ Underdrain	33.7728031,-118.326671	This development consists of residential lots, parking lots and private roads, and private equestrian facilities. A proposed riparian area will be designed as a bioretention system to retain and infiltrate runoff from from the site.	Existing	24.6 cf	28.62 acres
Palos Verdes Estates	R3	Malaga Cove Water Reuse	Feasibility Study	Diversion	33.798608, -118.378265	The City of Palos Verdes Estates has implemented dewatering measures to prevent nuisance groundwater from damaging homes and businesses. In the City of Rancho Palos Verdes, continuous-withdrawal dewatering wells have been installed to slow the progression of the Abalone Cove Landslide and the Portuguese Bend Landslide. The nuisance groundwater removed from these dewatering sites is currently discharged into the local storm drain system and/or to the nearby Pacific Ocean. This project proposes to divert this water to an existing golf course and potentially a school in Palos Verdes Estates for irrigation use.	Potential	Unknown	Unknown
Rancho Palos Verdes	R4	Abalone Cove Water Reuse	Feasibility Study	Diversion	33.741461, -118.373997	The City of Ranchos Palos Verdes has implemented dewatering measures to prevent nuisance groundwater from damaging homes and businesses. In the City of Rancho Palos Verdes, continuous-withdrawal dewatering wells have been installed to slow the progression of the Abalone Cove Landslide and the Portuguese Bend Landslide. The nuisance groundwater removed from these dewatering sites is currently discharged into the local storm drain system and/or to the nearby Pacific Ocean. This project proposes to divert this water to existing golf courses in Rancho Palos Verdes for irrigation use.	Potential	Unknown	Unknown

	R5	San Ramon Canyon	Peninsula Agencies NOI	Diversion	33.730522, -118.328346	The proposed project consists of the construction of a mid-canyon inlet structure, located slightly upstream of the upper switchback along PVDE and the highly-erodible section of the canyon to substantially reduce the amount of flow being delivered to an existing, and overwhelmed, storm drain at PVDS/25th Street, and improve water quality by substantially reducing erosion and minimizing debris transport to this drain. This project	Existing (currently under construction)	Unknown	Unknown

Appendix 4.A

SBPAT Land Use EMC Dataset

Table A-1: Data Summary for SBPAT Default LA County Land Use EMC Datasets[a]

Land Use		TSS	TP	DP	NH3	NO3	TKN	Diss Cu	Tot Cu	Tot Pb	Diss Zn	Tot Zn	Fecal Col.
Commercial	Count	31	32	33	33	33	36	40	40	40	40	40	5
	% ND	0%	3%	3%	21%	21%	3%	15%	0%	45%	10%	0%	20%
Industrial	Count	53	55	56	57	56	57	61	61	61	61	61	6
	% ND	0%	5%	9%	19%	5%	0%	15%	0%	43%	7%	0%	0%
Transportation	Count	75	71	71	74	75	75	77	77	77	77	77	2
	% ND	0%	1%	4%	27%	20%	0%	1%	0%	52%	6%	0%	0%
Education	Count	51	49	49	52	51	51	54	54	54	54	54	NA
	% ND	0%	0%	2%	35%	24%	0%	19%	0%	76%	39%	9%	NA
Multi-Family Residential	Count	45	38	38	46	46	50	54	54	54	54	54	7
	% ND	2%	3%	3%	24%	26%	0%	37%	7%	72%	41%	9%	0%
Single Family Residential	Count	41	42	42	44	43	46	48	48	48	48	48	4
	% ND	0%	0%	0%	16%	30%	0%	40%	4%	52%	81%	44%	0%
Agriculture (row crop)	Count	20	18	18	21	19	17	18	21	21	21	21	5
	% ND	0%	0%	0%	0%	5%	0%	0%	0%	0%	10%	0%	0%
Vacant / Open Space	Count	48	46	44	48	50	50	52	52	57	52	52	11
	% ND	2%	41%	57%	67%	2%	0%	90%	38%	88%	96%	77%	0%

[a] EMC data are based on 1996-2000 data for Los Angeles County land use sites (Los Angeles County, 2000), except for agriculture which are based on Ventura County MS4 EMCs (Ventura County, 2003) and fecal coliform which are based on 2000-2005 SCCWRP Los Angeles region land use data (SCCWRP, 2007b). These EMC datasets are summarized in the SBPAT User's Guide (Geosyntec, 2012). Open space fecal coliform EMC based on 2004-2006 SCCWRP data for Arroyo Sequit reference watershed, taken from (SCCWRP, 2005) and (SCCWRP 2007a).